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A SUPPLEMENTARY GUIDE FOR RAPID IDENTIFICATION OF THE LARVÆ OF ANOPHELES MINIMUS FLAVIROSTRIS (LUDLOW) AND ANOPHELES MANGYANUS (BANKS)[1]

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FOUR PLATES

King (1932), in his descriptive notes on the three Philippine *Anopheles* of the funestus-minimus subgroup, described the larvæ of *Anopheles minimus flavirostris* (Ludlow) and *Anopheles mangyanus* (Banks) as follows:

Anopheles minimus var. flavirostris.—Clypeal hairs simple and unfrayed, outer and posterior occassionally forked; the posterior hairs as a rule do not extend beyond the base of the inner (with the head in a horizontal position); inner submedian prothoracic hairs usually with more than 21 branches; leaflets of thoracic palmate tapered to a short point, without a filament; tergal plate of segment 1 narrow, oblong; plate of second segment deeply concave with the small median plate or a portion of the main plate detached; tergal plates on segments 3 to 7 usually convex posteriorly and narrowed toward ends; anterior tergal hairs (hair 0) usually arise well away from the plate; antepalmate hairs (hair 2) of segments 2, 3, and 7 branched from the basal third; dorsal surface of larva with heavy subdermal pigmentation.

Anopheles mangyanus.—Clypeal hairs similar to the above except that the outer and posterior are longer, the latter extending to or nearly to the edge of the clypeus; inner anterior prothoracic hairs usually with from 18 to 23 branches; leaflets of thoracic palmate hairs with a fine

[1] This study was made under the auspices of the U. S. Public Health Service in connection with the Philippine Rehabilitation Act of 1946 of the 79th Congress of the United States.

filament; tergal plates of segments 1 and 2 similar to var. *flavirostris*, those of segments 4 to 7 with broader ends; small submedian plates usually chitinized; anterior tergal hairs usually arise from the tergal plate, sometimes near the edge either just on or just off the plate; antepalmate hairs of segments 2 and 3 usually branched from the middle third; antepalmate hair of segment 7 simple, or occassionally forked apically, larvæ pigmented with abundant spots of opaque white that are collected into submedian streaks on the thorax.

Keys to larvæ of A. minimus flavirostris and A. mangyanus.—In 1934 Russell and Baisas made a key to the Philippine species of the genus *Anopheles*. The two species in question may be identified, thus:

1. Inner clypeal hairs widely separated 11
11. Inner and outer clypeal hairs simple 12
12. Palmate 1 developed 13
13. Tergal plates large 14
14. Leaflets of thoracic palmate hairs extended into long slender filaments; antepalmate VII simple or forked apically ..... *mangyanus*
Leaflets of thoracic palmate hair not extended into long slender filaments; antepalmate VII branched basally ..... *minimus* var. *flavirostris*

Russell, Rozeboom, and Stone (1934) adopted a key based on that by Russell and Baisas (1934), to wit:

1. Inner clypeal hairs widely separated 12
12. Clypeal hairs simple 13
13. Abdominal segment 1 with developed palmate hairs 14
14. Abdominal tergal plates large 15
15. Thoracic palmate leaflets produced into long slender filaments; abdominal segment 7 with antepalmate hairs (No. 2) single or forked apically ..... *mangyanus*
Thoracic palmate leaflets not produced into long slender filaments; abdominal segment 7 with antepalmate hairs (No. 2) branched basally ..... *minimus flavirostris*

In 1946, Baisas published a key to the larvæ of Philippine *Anopheles* based on natural groupings. It may be mentioned that this is now generally used in the identification of *Anopheles* larvæ in the Philippines.

The three species under Group Myzomyia (inner anterior clypeal hairs widely separated, tergal plates large) may be differentiated as follows:

1. Inner clypeal hairs with fine lateral branches; tergal plate II convex at the posterior border ..... *filipinæ*
Inner clypeal hairs simple; tergal plate II concave at posterior border 2

2. Antepalmate VII simple or branched apically; leaflets of thoracic palmate extended into long points..... *mangyanus*
Antepalmate VII branched near the base; leaflets of thoracic palmate taper into short blunt points..... *minimus* var. *flavirostris*

Bohart (1945) in his A Synopsis of the Philippine Mosquitoes, describes the larvæ of the above species as follows:

Anopheles (*myzomyia*) *mangyanus* (Banks).—The larva is characterized by its simple clypeal hairs, the short and stoutly branched prothoracic hair 1, the slender but well developed palmate hair on abdominal tergite I and the rat-tailed apices of the leaflets on the palmate hair of tergite IV. It is very close to *minimus flavirostris* which differs in the somewhat thicker apices of the leaflets on the thoracic palmate hair and in having antepalmate hair 2 of abdominal tergite VII single or apically forked.

Anopheles (*myzomyia*) *minimus flavirostris* (Ludlow).—The larva of this species closely resembles that of *mangyanus* but differs from it in having the apices of the thoracic palmate hair not drawn out into filaments and in having the antepalmate hair 2 of abdominal tergite VII branched basally.

It will be noted that of the three recognized Philippine species of the Group Myzomyia, *Anopheles filipinæ* Manalang is easily identified by the convex posterior border of the second tergal plate (large). But considerable difficulty has been encountered, especially by a novice, in the identification of *A. mangyanus* and *A. minimus flavirostris* (both with concave posterior border of tergal plate II). The thoracic palmate (Plate 1–A) and antepalmate VII (Plate 1–B) are not easy to locate, especially as in most cases the specimens are examined alive. Moreover, the character of the thoracic palmate leaflets can be appreciated best only when the high power objective (X 450) is used. This involves a considerable loss of time and may lead to erroneous identification especially when one has to examine hundreds of larvæ. When the thoracic palmate and the antepalmate VII are used as landmarks, even an experienced worker may have to take some time to arrive at a correct identification.

Oftentimes the aforementioned anatomical parts are detached or mutilated, in which case the examiner encounters considerable difficulty. The keys published by Russell and Baisas, Russell *et al*, and Baisas, mentioned previously, cannot afford any relief.

When confronted by this predicament, few resourceful examiners may resort to King's description of tergal plates III to VII, which are "usually convex posteriorly" in *A. minimus flavirostris*, or have "broader ends" in *A. mangyanus*. Russell and Baisas (1934) also described tergal plates IV to VII as rounded

or blunt at the edges in *A. mangyanus*, tapering towards the edges in *A. minimus flavirostris*. However, these and other authors, for some reason or other, made no mention of the specific importance of the tergal plate or plates, since they invariably point to the thoracic palmate and antepalmate VII in their keys to larvæ of Philippine anophelines.

TAXONOMIC IMPORTANCE OF TERGAL PLATE VII

It has been observed that the seventh tergal plate, not to mention the other tergal plates, has a constant and definite shape, and that the shape of the tergal plate in *A. mangyanus* differs from that in *A. minimus flavirostris*. The posterior border of the seventh tergal plate in *A. mangyanus* is more or less a straight line (Plate 2–C), while in *A minimus flavirostris*, it is convex or curved posteriorly (Plate 2–B).

This observation was subjected to an extensive and rigorous test, in the laboratory and in the field, in the hope of finding a variation or exception. Hundreds of specimens were examined and invariably the identification made according to the character of thoracic palmate leaflets and antepalmate VII corresponded with the identification made according to the character of the posterior border of the seventh tergal plate.

Carrying the test further, fifty *A. mangyanus* larvæ and also fifty *A. minimus flavirostris* larvæ were collected at different places and at different times and were individually bred out. Without exception, the imago identification was the same as the corresponding larval identification.

SUMMARY AND CONCLUSIONS

It will be seen that by the tergal plates alone, the three species under Group Myzomyia could be definitely and rapidly identified. The advantage of the seventh tergal plate over the thoracic palmate and antepalmate VII cannot be overemphasized. The first is easily located, cannot be detached, and the character of the posterior border can easily be appreciated even if live larvæ are examined as early as the second instar. On the other hand the thoracic palmate and antepalmate VII are easily detached or mutilated, and not easily located, and their characters are not easily evaluated especially when the specimen is examined alive.

A comparative illustration of the landmarks used in the identification of the larvæ of *A. minimus flavirostris* and *A. mang-*

yanus, both those adopted in keys to larvæ and those described in this papers, are shown in Plate 3 and Plate 4.

The following key to the larvæ under Group Myzomyia, that is, the larvæ with large tergal plates, may be adopted especially where rapid identification is desired.

1. Tergal plate II with convex posterior border ..... *filipinæ*
   Tergal plate II with concave posterior border..... 2
2. Tergal plate VII with convex posterior border.
   minimus flavirostris
   Tergal plate VII with more or less straight posterior border.
   mangyanus

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ILLUSTRATIONS

PLATE 1

FIG. 1. Thoracic palmate of *A. mangyanus* and *A. minimus flavirostris*, compared. Character of leaflets can best be appreciated by using high power magnification (X 450).

2. Antepalmate VII of *A. mangyamus* and of *A. minimus flavirostris*, compared. Its relation to other structures, indicated.

PLATE 2

FIG. 1. Tergal plates of *A. filipinæ*. Second tergal plate with convex posterior border.

2. Tergal plates of *A. minimus flavirostris*. Second tergal plate with concave posterior border. Seventh tergal plate with convex posterior border.

3. Tergal plates of *A. mangyanus*. Second tergal plate with concave posterior border. Seventh tergal plate with more or less straight posterior border.

PLATE 3

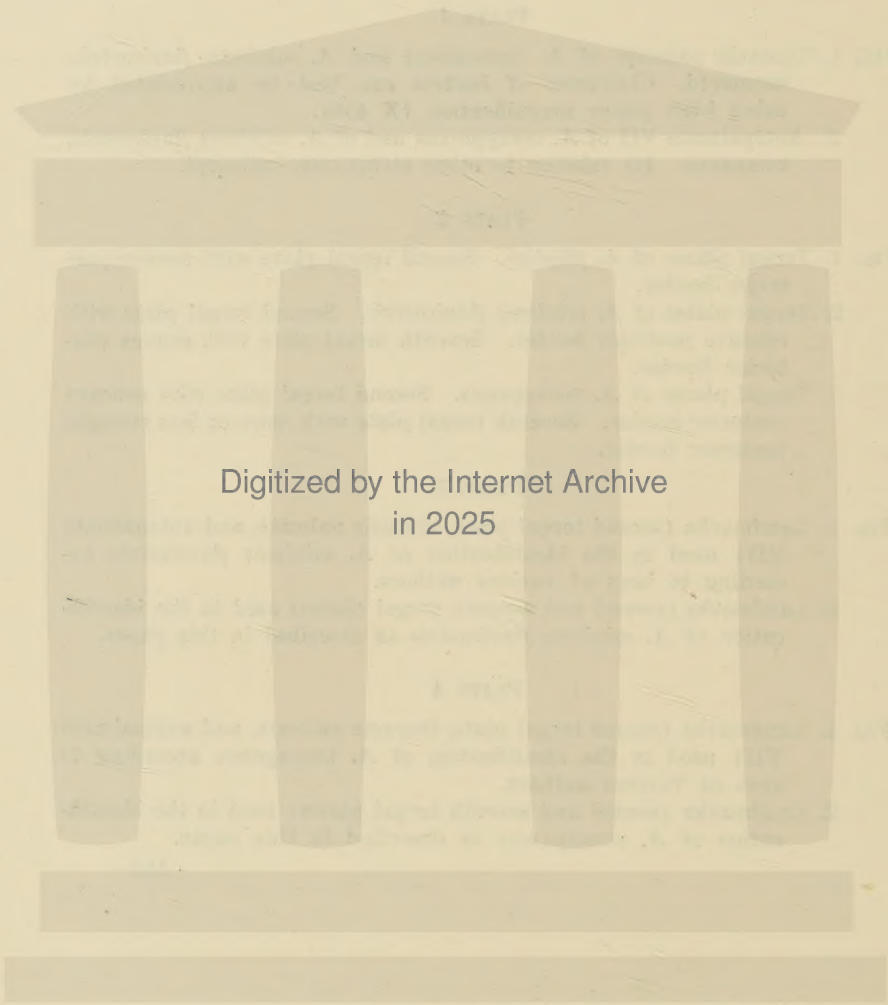
FIG. 1. Landmarks (second tergal plate, thoracic palmate, and antepalmate VII) used in the identification of *A. minimus flavirostris* according to keys of various authors.

2. Landmarks (second and seventh tergal plates) used in the identification of *A. minimus flavirostris* as described in this paper.

PLATE 4

FIG. 1. Landmarks (second tergal plate, thoracic palmate, and antepalmate VII) used in the identification of *A. mangyanus* according to keys of various authors.

2. Landmarks (second and seventh tergal plates) used in the identification of *A. mangyamus* as described in this paper.



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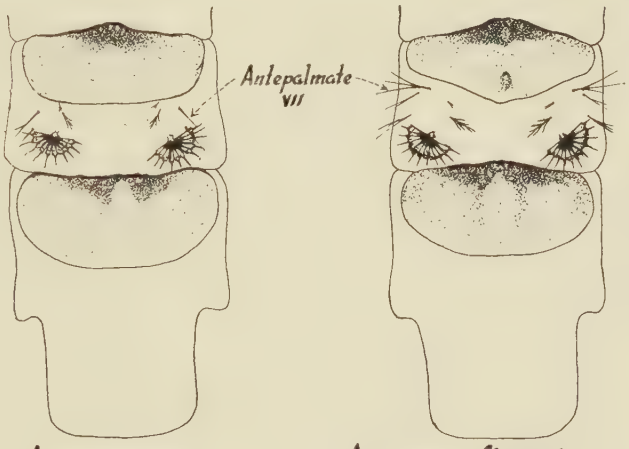
A. mangyanus A. minimus flavirostris

1



A. mangyanus 2 A. minimus flavirostris

PLATE 1.

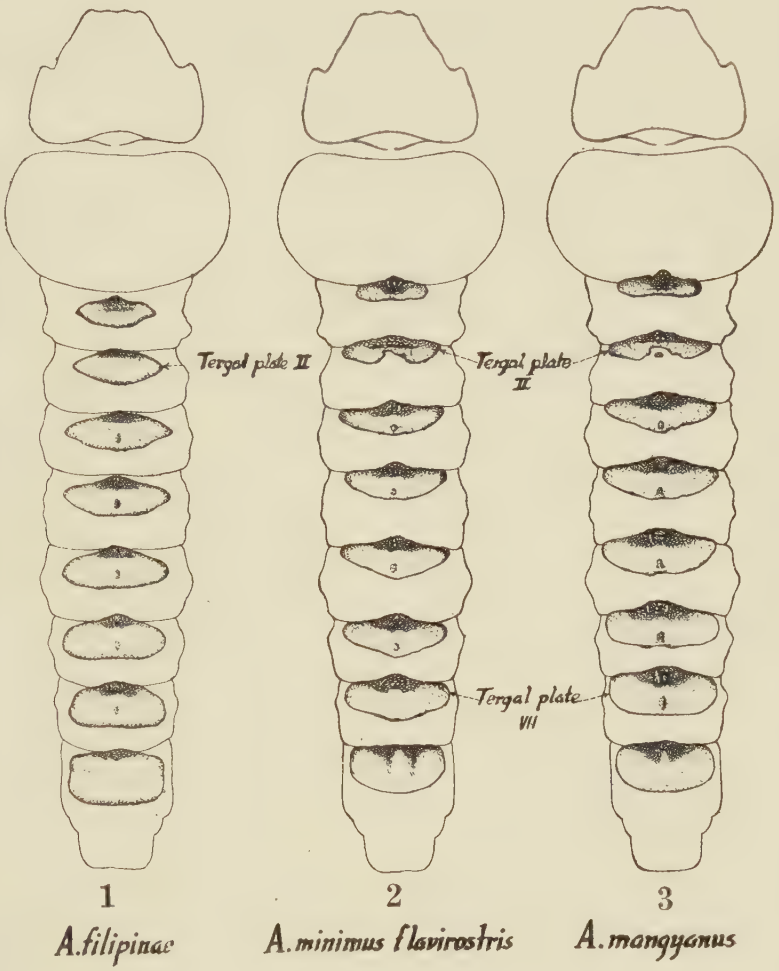

Tergal plate II
Tergal plate II
Tergal plate VII
1
2
3
A. filipinae
A. minimus flavirostris
A. mangyanus

PLATE 2.

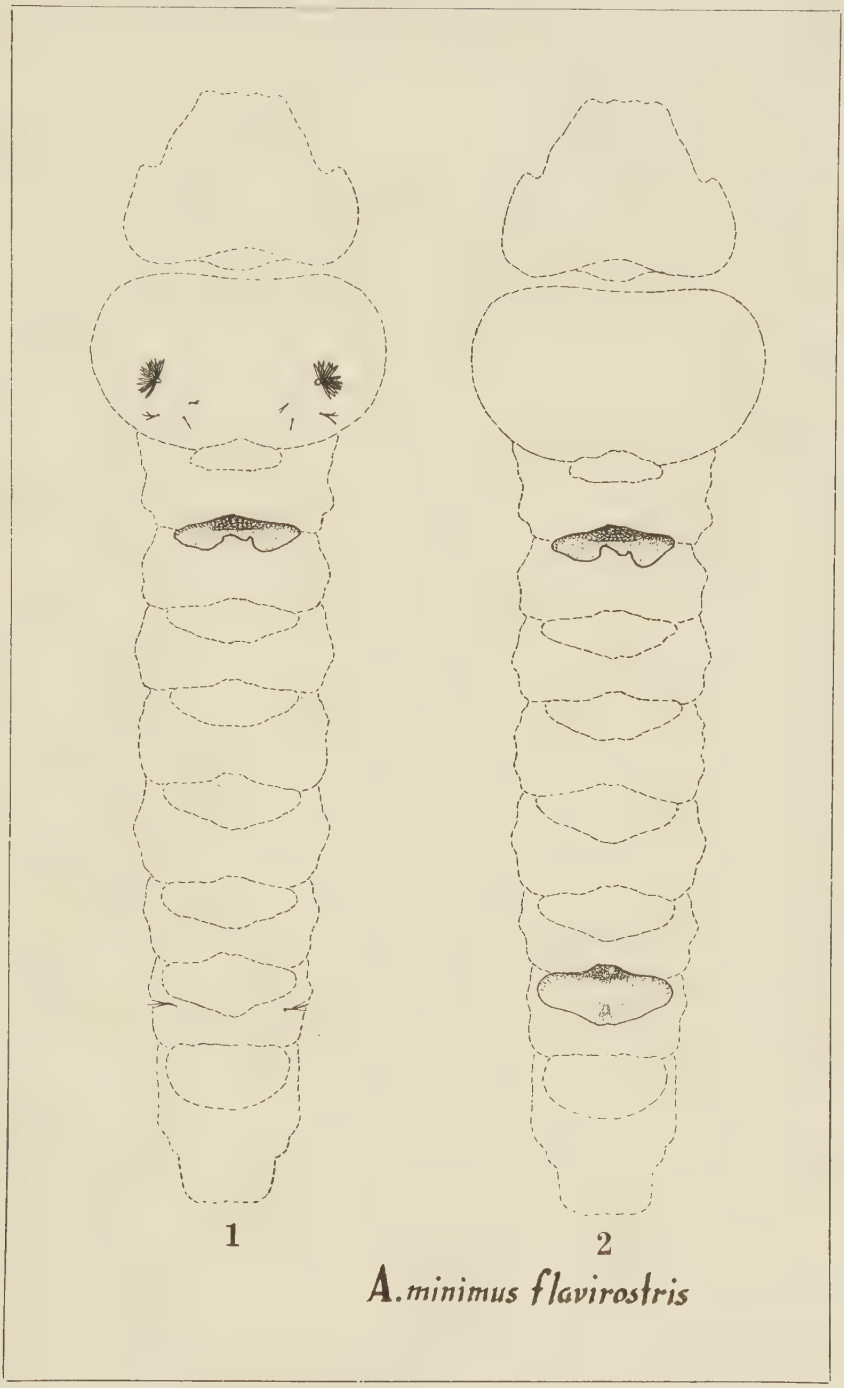


PLATE 3.

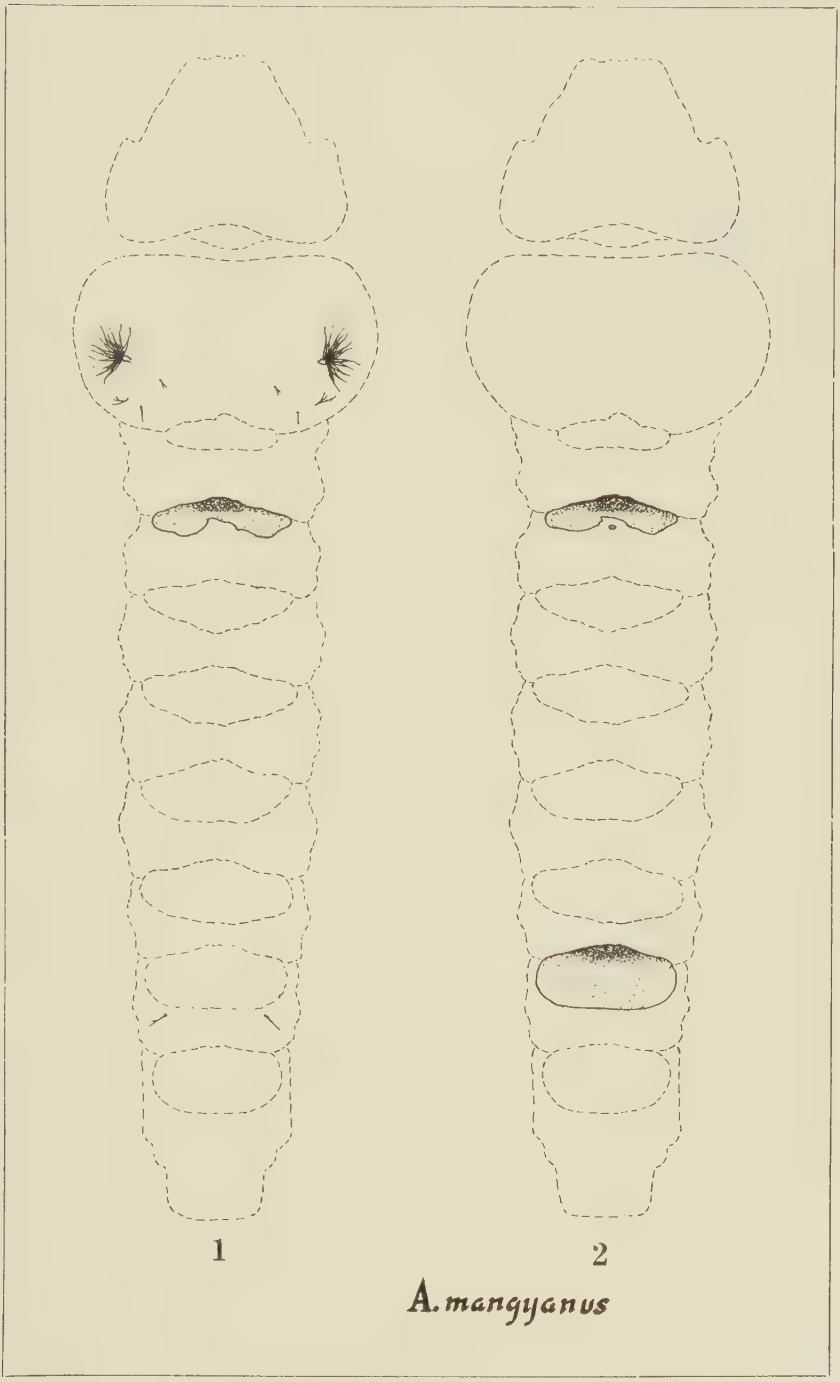


PLATE 4.

OBSERVATIONS ON THE MODE OF ACTION OF NAGANOL (BAYER 205) AS A TRYPANOCIDAL AGENT

By Deogracias J. Cabrera
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In the Philippines naganol [1] is extensively used in the treatment and prophylaxis of equine and bovine surra, a disease due to infection with *Trypanosoma evansi* (Steel, 1885). The dose of the drug ordinarily advocated and employed by most veterinarians is 0.5 gm. per 100 pounds of body weight, but there are those who claim that a large knockout dose should be used in order to effect Ehrlich's *therapia magna sterilizans.*

Before and during the early part of World War II, the writer conducted a series of *in vitro* and *in vivo* studies on the mode of action of naganol and other trypanocidal drugs. The object was to determine whether the drug has a direct trypanocidal effect and if it is more rapidly lethal to the trypanosomes in bigger doses. Several investigators, using various species of trypanosomes, have postulated that naganol has no direct trypanocidal effect, but according to the available literature the mode of action of the drug against *T. evansi* has not yet been studied.

MATERIALS

The strain of *Trypanosoma evansi* used in the *in vitro* studies was originally obtained from a naturally infected Philippine pony and was maintained in the laboratory in guinea pigs. The trypanosomes used in the *in vivo* experiments were from the blood of four horses, of which Horses A, B, and C were naturally infected animals which were brought to the laboratory for treatment. Horse C was a case which had relapsed from a previous treatment (drug used presumably naganol) instituted in one of the veterinary hospitals in Manila; Horses A and B were primary cases. Horse D was infected with trypanosomes from an experimental rat.

[1] Also known as Bayer 205, germanin, antrypol, suramin, moranyl, Forneau 309.

EXPERIMENTAL

Exposure of T. evansi to naganol in vitro:

Experiment 1.—On October 15, 1940, two drops of horse blood teeming with trypanosomes (100,000,000 per c.c.) were added to each of three tubes containing 5 c.c. of a medium composed of equal parts of horse serum and Locke's solution with 0.2 per cent glucose and 0.1 mg. naganol per c.c. of the serum-Locke solution. The same amount of infected horse blood was added to each of two tubes containing 5 c.c. of the serum-Locke-glucose medium but with no naganol. The mixtures were left at room temperature for a period of three hours, after which they were centrifuged and the sediments washed two times with 0.85 per cent sodium chloride solution. A drop of the sediment was examined under the microscope and if found positive for actively motile trypanosomes, one-half of the remaining sediment resuspended in 1 c.c. of the supernate was inoculated into a white rat. Three white rats, Nos. NR–1, NR–2 and NR–3, were each inoculated in this manner with the sediments of the test tubes containing naganol and two other rats, Nos. OR–4 and OR–5, were inoculated with the sediments of the control tubes which contained no naganol in the medium.

The number of trypanosomes inoculated per rat, in both the naganol and the control rats, was approximately 3,000,000 per 100 gram body weight, assuming that one-third of the original number was either lost or killed during the process of centrifugation.

Results.—The results are shown in Table 1. Rats NR–1, NR–2 and NR–3, which were inoculated with the naganol-exposed trypanosomes remained healthy, and no trypanosomes were seen in their peripheral blood during a six-month-period of observation. Control rats OR–4 and OR–5, on the other hand, showed the presence of trypanosomes in their blood on the fourth day from the time of inoculation and died on the seventh and eighth day, respectively.

TABLE 1.—*Showing the effect of naganol in vitro on the infectivity of Trypanosoma evansi*

Naganol conc.	Length of exposure *in vitro*	Trypanosomes before inoculation	Inoculated rats	Period of observation of rats	Result
per c. c.					
0.1 mg.	3 hours	very active	NR-1	6 months	Negative
0.1 mg.	3 hours	very active	NR-2	6 months	Negative
0.1 mg.	3 hours	very active	NR-3	6 months	Negative
0.0	3 hours	very active	OR-4	7 days	Positive on 4th day; died on 7th day.
0.0	3 hours	very active	OR-5	8 days	Positive on 4th day; died on 8th day.

Exposure of T. evansi to naganol in vivo:

Experiment 2.—On August 13, 1942, Horse A, whose blood was teeming with trypanosomes, was given 0.6 gm. of naganol per 100 pounds of body weight intravenously. This dose, which is higher than the usual initial therapeutic dose recommended by veterinarians in the treatment of surra in the horse, was calculated to give a blood concentration of approximately 0.14 mg. of the drug per c.c. The calculation was based on the probable blood volume of the animal, assuming that the total amount of blood in the horse is 9.7 per cent (Welcher, cited by Dukes, 1942) of the body weight and taking 1.06 as the specific gravity of horse blood. After the injection, blood from the animal was examined microscopically for trypanosomes from time to time during a period of twenty-seven hours.

Blood samples were withdrawn from the horse three hours and twenty-seven hours after the injection. One drop from each sample, which was positive for actively motile trypanosomes, was added to 5 c.c. of 1 per cent sodium citrate solution and 1 c.c. of the mixture was injected subcutaneously into a white rat (HR–6 was given the three-hour sample and HR–7 the twenty-seven-hour sample). The amount of naganol carried over with the horse blood into each rat was calculated to give a rat blood level of about 0.13 micrograms per c.c.

Results.—The results are given in Table 2. Actively motile trypanosomes were observed in the blood of Horse A during a period of observation which lasted for twenty-seven hours.

Rat HR–6 was observed for a period of forty-seven days; Rat HR–7 for one hundred seventeen days. No trypanosomes were seen in the blood of these animals during the respective periods of observation.

TABLE 2.—*Showing the effect of naganol in vivo on the infectivity of Trypanosoma evansi*

Source of trypanosomes	Approximate naganol conc. in horse blood	Period of exposure *in vivo*	Trypanosomes before inoculation	Inoculated rats	Period of observation of rats	Result
Horse A	0.14 mg.	3.13 hours	very active	HR-6	47 days	Negative
Horse A	0.14 mg.	26.88 hours	very active	HR-7	117 days	Negative
Horse B	0.14 mg.	2.00 hours	very active	HR-8	36 days	Negative
Horse B	0.14 mg.	3.00 hours	very active	HR-9	36 days	Negative
Horse C	0.14 mg.	2.17 hours	very active	HR-10	15 days	Positive on 9th day; died on 15th day.
Horse C	0.14 mg.	3.25 hours	very active	HR-11	22 days	Positive on 11th day; died on 22nd day.

Experiment 3.—On October 21, 1942, another naturally infected animal (Horse B) was treated with naganol to give a blood level of about 0.14 mg. of the drug per c.c. Blood samples were withdrawn two hours and again three hours after the injection of the drug. One drop from each of these blood samples was added to 5 c.c. citrate solution and 1 c.c. of the resultant mixture inoculated into a white rat (HR–8 was given the two-hour sample and HR–9 the three-hour sample).

Results.—The results are shown in Table 2. Actively motile trypanosomes were demonstrated in every blood sample of Horse B examined at different intervals during a period of twenty-one hours.

No trypanosomes were seen in the blood of Rats HR–8 and HR–9 during a period of observation of thirty-six days.

Experiment 4.—This experiment is the same as Experiment 3, except that the animal used (Horse C) was a case which had relapsed from a previous treatment with naganol.

Results.—The results are shown in Table 2. Actively motile trypanosomes were found in the blood of Horse C examined at different intervals during a period of twenty-one hours.

On the ninth day from the time of inoculation, Rat HR–10 was found positive for trypanosomes in the peripheral blood and died on the fifteenth day; Rat HR–11 showed the organisms on the eleventh day and succumbed on the twenty-second day. The long prepatent period and the protracted course of the infection in these animals are unusual and seem to indicate that either the virulence or the integrity of the parasites has been altered in some way by exposure to the drug.

Experiment 5.—On August 14, 1941, experimentally infected surra Horse D was given by the intravenous drip method massive doses of naganol in two installments. The first installment, at a dose of 0.7 gm. per 100 pounds of body weight, was administered continuously during a period of two hours; the second, after an interval of three hours at a dose rate of 1.3 gm. per 100 pounds of body weight, was given continuously for another period lasting two hours. The sum total of the drug given was approximately 2 gm. per 100 pounds of body weight, or four times the usual therapeutic dose. Calculated from the live weight of the animal, this was equivalent to a naganol blood level of about 0.48 mg. per c.c.

After the administration of the first dose and again after the second dose, blood was withdrawn and examined for trypa-

nosomes. Blood samples were also examined after twenty-two and twenty-eight hours from the time the first dose was given.

Results.—The results are given in Table 3. After the administration of the first and second doses, the blood of this animal was found swarming with trypanosomes; twenty-two hours after the administration of the first dose only a few but still actively motile trypanosomes were present; in the twenty-eight-hour sample no trypanosomes were found. (The results of this experiment will be reported in greater detail in another paper.)

TABLE 3.—*Showing the result of blood examination of treated horses at different intervals after intravenous injection with naganol*

Naganol treated horses	Approximate drug level *in vivo*	Microscopic findings in blood at different intervals											
		1.73 hr.	2 hr.	2.17 hr.	3 hr.	3.13 hr.	3.25 hr.	8.5 hr.	20.75 hr.	20.83 hr.	22 hr.	26.88 hr.	28 hr.
	per c. c.												
A	0.14 mg.					Swarming with actively motile trypanosomes						Few; trypanosomes, actively motile	
B	0.14 mg.		Swarming with actively motile trypanosomes		Swarming with actively motile trypanosomes					Markedly reduced; trypanosomes, actively motile			
C	0.14 mg.			Swarming with actively motile trypanosomes			Swarming with actively motile trypanosomes		Markedly reduced; trypanosomes, actively motile				
D	0.16 mg.	Swarming with actively motile trypanosomes						Swarming with actively motile trypanosomes			Few; trypanosomes, actively motile		Negative for trypanosomes
	0.48 mg.												

DISCUSSION

The results of the *in vitro* study reported in Experiment 1 show that naganol (Bayer 205) has a disarming action against *Trypanosoma evansi,* for although the exposed trypanosomes were actively motile when inoculated to rats they failed to cause infection. Several investigators (Nauck, 1925; Reiner and Koveskuty, 1927; Issekutz, 1933 and Hawking, 1939), working with different species of trypanosomes, have called attention to this disarming action of the drug. According to Reiner and Kovestuky (1927), Jancso and Jancso (1934) and Hawking (1939), this property of naganol has an opsonizing effect which renders the trypanosomes more sensitive to phagocytosis by the reticulo-endothelial system. Culbertson's (1939) observation on the more prompt action of germanin against *T. equiperdum* in old compared with young rats, which he believes to be related to a difference in the phagocytic capacities of the cells of rats of different age groups, and Hawking's (1940) success in culturing trypanosomes from the blood of a patient whose plasma-germanin level was 0.42 mg. per c.c., all seem to point to the conclusion that naganol has no direct trypanocidal activity.

The results of the *in vivo* experiments also point to the same conclusion, for it will be noted that the trypanosomes persisted in the blood of all the treated animals for twenty or more hours after the administration of the drug irrespective of dose size used. If the drug had a direct trypanocidal activity, a more prompt knockout effect could be expected by the use of large doses of it. This was not borne out by the results of Experiment 5 in which trypanosomes were seen in the blood of Horse D twenty-two hours after it was given massive doses of the drug.

Although the trypanosomes obtained from the experimental horses were not washed before inoculation into rats, the amounts of naganol carried over from the former to the latter are believed to be negligible. At most, the concentration of the drug in the inoculated rats could not have been more than 0.135 micrograms per c.c. of blood. Against highly virulent strains of *T. brucei,* Vierthaler and Boselli (1939) have found 1.3 mg. per 100 c.c. of blood (13 micrograms per c.c.) to be the smallest protective blood level of germanin (naganol) in the blood of rabbits. Against a strain of *T. rhodesiense,* Hawking (1939) has noted 0.2 mg. per 100 gm. rat (about 22 micrograms or

gamma per c.c.)[1] as the minimum effective dose. These amounts are 95 and 160 times greater than the calculated blood level of naganol in our experimental rats.

In rats inoculated with the blood of Horse C, the presence of a naganol-resistant strain of trypanosomes remains to be considered. It is to be recalled that Hawking (1939), using *T. rhodesiense*, has found germanin-resistant trypanosomes not to lose their infectivity upon incubation *in vitro* with as much as 1 mg. of naganol per c.c. of medium. With normal trypanosomes he found 0.1 mg. per c.c. to be sufficient to render the organisms noninfective to mice.

It is possible that Horse C, before coming to hand, had already been treated for surra with doses of naganol too small to be effective but enough to allow the trypanosomes to gradually develop tolerance against the drug, as has been observed by Van Hoof, Henrard and Peel (1938a) with *T. gambiense*. It is also possible that drug resistance may have been acquired after repeated exposures of successive generations of the strain to subcurative levels of naganol in the blood of one or more hosts of the same or different species. For these reasons, the potential danger of producing drug-tolerant strains of *T. evansi* through the unintelligent and indiscriminate use of naganol as a prophylactic and as a treatment for equine and bovine surra in the field should be borne in mind.

SUMMARY AND CONCLUSION

The effect of naganol against *Trypanosoma evansi in vitro* and *in vivo* was studied.

Virulent trypanosomes exposed *in vitro* for three hours to a naganol (germanin) concentration of 0.1 mg. per c.c. were rendered noninfective to white rats.

Blood swarming with trypanosomes obtained from two horses naturally infected with surra two, three and twenty-seven hours after the intravenous administration of naganol failed to infect white rats.

Blood obtained from a naturally infected horse, which had relapsed from a previous treatment (presumably with naganol), two and three hours after the intravenous injection of naganol, was infective to white rats which died after unusually long prepatent and patent periods. It is believed that the infection in this horse was due to a strain which was naganol-resistant

[1] Calculation in terms of blood level is by the present writer.

due to previous unsuccessful treatment with subcurative doses of the drug or as a result of repeated exposures of one or more generations of the strain to ineffective levels of the drug in the blood of one or more hosts of the same or different species. The potential danger of producing naganol-resistant surra organisms through the indiscriminate use of the drug in the field is pointed out.

In all of the naganol-treated horses, the trypanosomes were found actively motile up to twenty-seven hours after the administration of the drug. The organisms, however, were found to have markedly decreased in number at about the twentieth to the twenty-sixth hour.

The apparent lack of positive correlation between dose size of the drug and the rate of disappearance of the parasites in the peripheral circulation lends support to the hypothesis that naganol is indirectly trypanocidal.

ACKNOWLEDGMENT

The writer is much indebted to Dr. Zacarias de Jesus, former chief of the Parasitology and Protozoology Division, Bureau of Animal Industry and now Professor and Head, Department of Parasitology and Protozoology, College of Veterinary Science, University of the Philippines, without whose help and encouragement this study could not have been accomplished.

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COMPOSITION OF PHILIPPINE SINGKAMAS OIL FROM THE SEEDS OF PACHYRRHIZUS EROSUS (LINN.) URB.

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Singkamas oil is obtained from the seeds of an hairy herbaceous vine known botanically as *Pachyrrhizus erosus* (Linn.) Urb. Recently the composition of the oil was determined and the results showed that this oil consists principally of glycerides of oleic, linolic and saturated acids and is very similar in composition to kapok, rice, cottonseed, and peanut oils.

Brown and West [1] give the following description of *Pachyrrhizus erosus*:

> *Pachyrrhizus erosus* is a rather coarse, somewhat hairy, herbaceous vine. The leaves are compound with 3 leaflets which are up to 15 cm. in length and 20 cm. in width. The flowers are pale blue or blue and white, 2 to 2.5 cm. long and borne in racemes which are up to 45 cm. in length. The pods are about 10 cm. long, 10–12 mm. wide, flat, hairy and contain from eight to ten seeds. The roots are large, fleshy, turnip-shaped. They are eaten raw or prepared in a variety of ways. The young fruits are sometimes eaten as a vegetable.
>
> This species is a native of tropical America, but is now widely distributed in the tropics. It is thoroughly naturalized in the Philippines and is common in thickets. It is also extensively cultivated.

Heyne [2] stated that Greshoff found in the seeds 38.4 per cent of a colorless, limpid oil.

Lately several articles, dealing on the insecticidal property of *Pachyrrhizus erosus* beans, also known as yam beans, either alone or mixed with some other rotenone bearing plants were published. The results indicate the possibility of utilizing yam beans as insecticides.

L. B. Norton [3] obtained by extracting the ground yam beans with ether, 1.4 per cent of the insecticidally active resin, after removing the oil.

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[1] P. I. Bureau of Forestry, Bull. **20** (1920).
[2] De Nuttige Planten van Nederlandsch-Indie 2 (1916) 346.
[3] Jour. Am. Chem. Soc. **65** (1943) 2257–60.

Shui-Luen Hwang [4] reported to have obtained 0.56 to 1.01 per cent of rotenone from twelve samples. He further stated that oil expressed from the seeds contained rotenone to an extent to make it of insecticidal value.

EXPERIMENTAL PROCEDURE

The singkamas seeds used in this investigation were supplied through the kindness of Director Felix D. Maramba of the Bureau of Plant Industry. The seeds were ground to fine powder. The composition of singkamas seeds compared with soy beans is given in Table 1.

TABLE 1.—*Composition of Philippine singkamas seeds compared with Philippine soy beans.*

Constituent	Philippine	
	Singkamas seeds	Soy beans
	Per cent.	*Per cent.*
Moisture	9.3	5.
Oil (ether extract)	19.7	20.
Protein	29.5	39.7
Crude fiber	7.2	5.0
Ash	6.5	5.3
Carbohydrates (by diff.)	27.8	25.0
Total	100.0	100.0

As shown by the data singkamas seeds have a high protein content like soy beans.

Singkamas oil was prepared by extracting the ground seeds with ether. The extracted oil was purified by treating it with about 2 per cent of activated carbon. This treatment removes vegetable fibers and colloidal matter and produces a brilliantly clear yellowish brown oil.

The constants of this sample of Philippine singkamas oil are given in Table 2.

TABLE 2.—*Physical and chemical constants of Philippine singkamas oil.*

Specific gravity at 31°/4°C	0.9186
Refractive index at 31°C	1.4730
Saponification value	182.9
Acid value	2.6
Iodine number (Hanus)	84.1
Thiocyanogen value	56.8
Unsaponifiable matter	2.2

The saturated and unsaturated glycerides in singkamas oil were calculated from the iodine and thiocyanogen values in

[4] Kwangsi Agri. 2 (1941) 296–80

accordance with the Official and Tentative Methods of the American Oil Chemists' Society. The results are recorded in Table 3. Included in Table 3 are compositions of other Philippine and American oils for comparison. As shown by the data Philippine singkamas oil is very similar in composition to rice, kapok, cotton seed and peanut oils. All these oils consist principally of glycerides of oleic, linolic and saturated acids.

TABLE 3.—*Comparison of Philippine singkamas oil with other oils.*

	Philippine oils.			American oils.	
	Singkamas oil	Kapok seed oil [a]	Rice oil (Hambas) [b]	Cotton seed oil [c]	Peanut oil [d]
Glycerides of:	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Unsaturated acids—					
Oleic	32.9	49.8	45.6	35.2	52.9
Linolic	26.4	29.3	27.7	41.7	24.7
Saturated acids—	38.5	19.5	20.7	22.9	21.5
Unsaponifiable matter	2.2	0.8	4.0		0.2
Total	100.0	99.4	98.0	99.8	99.3

[a] Philippine kapok-seed oil (*Ceiba pentandra* Gaertner), analyzed by A. O. Cruz and A. P. West. Philip. Jour. Sci. **46** (1931) 131.

[b] Philippine rice oil (Hambas variety), analyzed by A. O. CRUZ and A. P. West. Philip. Jour. Sci. **47** (1932) 487.

[c] American cottonseed oil analyzed by G. S. Jamieson and W. F. Baughman. Jour. Am. Chem. Soc. **42** (1920) 1197.

[d] American peanut oil (Spanish type), analyzed by G. S. Jamieson, W. F. Baughman and D. Brauns Jour. Am. Chem. Soc. **43** (1921) 1372.

SUMMARY

Data recently published by several investigators showed the possibility of utilizing singkamas seeds as a source of insecticides.

Singkamas seeds have, like soy beans, a high protein content.

In this investigation the composition of Philippine singkamas oil obtained from the seeds of this plant by ether extraction was determined. The results indicate that the oil consists principally of glycerides of oleic, linolic and saturated acids. Singkamas oil resembles kapok, rice, cottonseed and peanut oils, although in different proportions.

A NEW LABRID AND OTHER INTERESTING PHILIPPINE FISH RECORDS

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The writer completed his Checklist of Philippine Fishes in May, 1948. This work lists 2,145 species actually known within the political boundaries of the Republic of the Philippines. Were one to include the names of those fishes recorded from nearby localities within 10 to 100 miles of Philippine soil, and certain to be captured in Philippine waters later on, the number would reach 2,300 or more. Intensive collecting almost anywhere in the Philippines will bring additions to the fish fauna of the Islands.

One of the least known regions of the Philippines, as far as its fish are concerned, is the east coast of Luzon, north of the latitude of Manila. I, therefore, take pleasure in presenting the description of a new labrid from that region. With it are also some notes upon a few other fishes, two of them new to the Philippines.

CHOERODON BALERENSIS, sp. nov.

Dorsal XII–8; anal III–9; pectoral II–13; scales in the lateral line 26, plus 3 on the caudal base; the tubules of the anterior half of the lateral line are branched, becoming simple posteriorly. Three scales above the lateral line to the first dorsal spine, 9 below. Dorsal and anal each with a high basal scaly sheath. 8 predorsal scales; a band of smaller scales behind the interorbital region above the posterior part of the eye, followed by a narrow naked area.

The form is oval, the dorsal and ventral profiles both uniformly convex, the depth 2.3 times in the length. The head is rather small, 2.8, the truncate caudal 3.5 times in the length. The large prominent eye is high up, 3.85 times in the head, its diameter a little less than the width of the slightly convex interorbital, 1.46 times in the snout, which is 2.63 in the head. The maxillary equals the interorbital, its posterior angle extending back below the anterior half of the eye, 3.57 in the

head. The canines are prominent, the outer pair of the mandible much the largest; no posterior canine. The preopercle with 9 rows of scales, its posterior and inferior limbs naked, its posterior border smooth; the opercle with 4 rows of scales, the two most posterior much the largest. The scales forming the posterior row at the caudal base enlarged and pointed.

Dorsal and anal relatively low, their real height concealed by the high basal sheath, the five posterior spines equal to or slightly longer than the snout; the membranes between the spines are deeply incised and prolonged in a filament extending beyond each spine. The soft dorsal equals the spinous in height. The first anal spine equals the eye, the third equals the snout, the second is nearly as long; the anal rays like the soft dorsal. Pectorals broad, the upper rays elongate, pointed, 1.16 in the head; ventrals short, not reaching the anus, 1.78 in the head; least depth of caudal peduncle 2.27 in the head; upper caudal rays slightly produced.

In life the general color dorsally was dusky, with a broad dusky or blackish band covering the posterior part of the body from the anterior part of the soft dorsal to the anal and back to the caudal base. Six brilliant orange bands with very dark blue margins girdled the body; the first descended from the eye, the second from the nape, the third from the dorsal origin, the sixth from the last dorsal spine and first dorsal ray. The lower part of the head and body was pale to whitish. Across the snout were two orange bands with indigo margins, and a broad orange band connected the eyes. The strong canine teeth were bright blue. The dorsal and anal each had a broad longitudinal orange band with deep indigo margins, their spines bright blue.

The tips of the dorsal filaments and margin of the soft dorsal and anal were indigo. The pectorals were clear yellow, the ventral spines blue, the rays orange. The caudal fin had a broad basal yellow band, the rest of the fin colorless.

In preservative, the orange cross bands blackened on the dorsal region but faded below, while their margins and the stripes and band on the head also blackened.

Here described from the type and sole specimen, 139 mm. long, obtained on a coral reef at Baler, Quezon (Tayabas) Province, Luzon. This fish is notable for its brilliant colors and striking color pattern. It was collected by Mr. R. B. Fox, anthropologist with the Philippine National Museum.

Key to Philippine Species of Choerodon

A. Ventrals greatly produced, extending upon anal in adults; silvery spot below middle of spinous dorsal, with a dark patch below it. *C. obligacanthus*

AA. Ventrals not reaching anal.

B. Body more elevated, depth 2.3 to 2.6 in length.

C. Six transverse orange bands with deep blue margins on head and body..... *C. balerensis*

CC. No pattern of cross bands.

D. Pale abdominal color extends upward as wedge or bar to lateral line below middle of spinous dorsal; caudal peduncle with pale saddle..... *C. anchorago*

DD. An orange or yellow band from pectoral axil to caudal base ..... *C. zamboangæ*

DDD. Pale line from snout through eye and small white spots on anterior scales of body. *C. margaritiferus*

BB. Body slenderer, depth 2.5 to 3.3.

E. A broad dark band on side of body.

E. A dark band from axil to pectoral to posterior part of dorsal, widening posteriorly; a broad silvery band above it..... *C. zosterophorus*

EE. A broad curved dark band from above pectoral tip to posterior part of soft dorsal. *C. melanostigma*

EE. No broad dark band on side; a dark spot below 3 posterior dorsal spines; a large pale blotch between soft dorsal and lateral line. *C. schoenleini*

Family SCYLLIORHINIDÆ

SCYLLIORHINUS TORAZAME (Tanaka)

Catulus torazame Tanaka Jour. Coll. Sci. Tokyo **23** (1908) 26, Plate *2*. Fig. *2*. Misaki, Sagami, Japan; Garman, Memoirs Mus. Comparative Zoology **26** (1913) 77, Misaki, Japan.

Halaelurus torazame Tanaka, Fishes Japan **5** (1912) 87; Schimdt, Rendu, Acad. Sci., U.S.S.R. (1930) 285, Figs. *1* and *2*, Tokyo, Fusan, Misaki; Schmidt, Copeia, No. 2 (1930) 48, Figs. *1–3*.

Scylliorhinus torazame Fowler, U. S. Nat. Mus., Bull. 100, **13** (1941) 36; Japan; Korea; after Tanaka.

Scylliorhinus rudis Pietschman, Anzieg. Akad. Wiss. Wien **45** (1908) 133, Japan.

Halaelurus rudis Tanaka, Fishes Japan **1** (1911) 13 Fig. *12*.

This little catshark has hitherto been known only from Japan and Korea, and is now recorded for the first time from the Philippines.

Among the sharks purchased at the Dumaguete market for use in the zoology class at Silliman University, Professor Guillermo Magdamo noticed some that were unlike any he had ever seen before. On examination I found them to be typical specimens of the white-spotted catshark of Japan, from 225 to 330 mm. in length. These sharks were taken off Dumaguete, Negros Oriental Province.

This little shark may be recognized by its numerous small circular white spots or dots, sprinkled on a gray background.

This is an altogether unexpected addition to the Philippine fish fauna. As Professor Magdamo drily remarked, "It is a part of the Japanese invasion."

ACHIROPHICHTHYS KAMPENI (Weber and de Beaufort)

A specimen of this little known snake eel, family *Ophichthyidae*, was obtained from the Mantugil River, 42 kilometers from the sea, in the Municipality of Villar, Zambales Province, Luzon. It is known to the Negritos there as "banota."

This is the fourth specimen known, and the second Philippine specimen. It was previously recorded from the Pinacanauan River, at Barrio Lamug, Municipality of Peñablanca, Cagayan Province, Luzon. This is over 100 kilometers from the sea. It was originally described from Humboldt Bay, New Guinea, near the mouth of the Mbai River. I also collected it in the Papenoo River, Tahiti, about a kilometer from the sea.

The Zambales specimen is 395 mm. long, the depth 26.3 mm., the head almost 8 times in the length. The eye is about 20 times in the head, and 2.5 times in the noticeably narrow and pointed snout. The lateral line is conspicuously marked by a row of circular yellow spots surrounding the pores.

The specimen agrees very well with the descriptions of other specimens, but has 5 canines on the vomer instead of 3 or 4.

Family SERRANIDÆ

CHELIDOPERCA HIRUNDINACEA (Cuv. and Val.)

Centropritis hirundaceus Cuvier and Valenciennes, Hist. Nat. Poiss. 7 (1831) 450, Japan; Schlegal, Poiss., Fauna Japan (1842) 14, Plate 5, fig. 1, Nagasaki.

Chelidoperca hirundacea Boulenger, Cat. Fishes, ed. 2, 1 (1895) 305, Japan and Arafura Sea, off the Kei Islands. Jordan and Richardson, Proc. U. S. Nat. Mus. 37 (1910) 464, Suruga Bay and Sagami Bay, Japan; Tanaka, Fishes Japan 12 (1912) 343, Plate 92, figs. 296 and 297, Nagasaki to Tokyo.

Centropristis pleurospilus Günther, Reports Challenger Exped. Zoology 1 part VI, Shore Fishes (1880) 37, Plate XVI, Fig. D, Kei Islands.

Three examples, 53, 86, and 105 mm. in length, were taken by trawl at the entrance to Manila Bay, in 65 fathoms of water. Dorsal X–10; anal III–5 or 6; scales in lateral line 44. Our specimens all have a row of 5 black spots along the side; in the smallest specimen they form an almost continuous bar. With age the spots separate and eventually disappear in adult life.

This is another interesting addition to the Philippine fish fauna. Previously it has been known only from Japan and off the Kei Islands, which lie between New Guinea and Australia.

Family SCORPAENIDÆ

GYMNAPISTES NIGER (Cuv. and Val.)

This little severely stinging catfish is known from India through the East Indies to the Philippines. It seems to be rather common throughout its range, and is primarily a reef fish of shallow coastal waters. In the Philippines at least, it enters rivers and travels considerable distances from the sea.

Long ago I obtained it from the Tanjay River, Negros Oriental Province, less than a kilometer from the sea. In 1940, in company with Mr. P. R. Manacop of the Philippine Bureau of Fisheries, I collected it in a shallow rapid in the Cagayan River, Misamis Oriental Province, Mindanao, about 15 kilometers from the sea. In July, 1947, Mr. R. B. Fox, anthropologist of the Philippine National Museum, obtained 4 specimens from the Bañgan Labaw River at Villar, Zambales Province, Luzon. This locality is in the Zambales Mountains, 40 kilometers from the China Sea. These fish ranged in length from 59 to 89 mm. Specimens 85 to 89 mm. in length were several times as bulky as the shortest specimen.

This stinging fish is well known to the Negritos of the Zambales Mountains, who call it "napo". As scorpion fishes are characteristically marine reef–dwellers, it seems noteworthy that this species should leave the sea to dwell in hill streams. Apparently they like to live in shallow rapids, where their dark mottled forms blend indistinguishably with the volcanic gravel and stones that strew the bottom of the stream.

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OBSERVATIONS ON THE DISTRIBUTION OF TRYPANOSOMA EVANSI IN THE BODIES OF RATS AND GUINEA PIGS DURING DIFFERENT STAGES OF INFECTION

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INTRODUCTION

Since trypanosomes are blood-inhabiting protozoan parasites, most writers tend to take the attitude that the flagellates in an infected animal are found in all the body juices. They are said to be present in enormous numbers in one part of the body while but a few in another. Animals having many parasites in the peripheral circulation, when killed show them also in the organs. However, if they are not demonstrable by microscopic examination in the former, they are also not found in the latter. The blood of animals suffering from the disease is always infectious by animal inoculation, although there are periods during its course when the trypanosomes can not be found for days by microscopic examination of the peripheral blood. Plimmer and Bradford (1889) and others working with tsetsefly trypanosomes state that the lymphatics near the point of inoculation first show the parasite and that the blood of the animal may be infectious for two days before the parasites are found in it.

According to Voges (1901) the whole cycle of the parasite of "mal de caderas," a species of trypanosome of the *evansi* group, takes place in the blood; and it would seem that the experiments conducted to determine the place of multiplication in the body of the host tend to substantiate this statement. It is true that the trypanosomes are pretty evenly distributed in the body juices and that similar forms are found in all parts of the body. Further, Musgrave and Clegg (1903) state that when an animal, in the blood of which trypanosomes are present, dies, the organisms are then found in all organs; and conversely, where none appear in the former, they are also absent in the latter. They are generally distributed and multiplication forms do not appear in exceptional numbers in

any organ. However, they are usually somewhat more numerous in the spleen, liver and the lymphatic glands than in the bone marrow, and are seldom present in the medullary canal. They are found in the serous fluids and exudate of the joints, but rarely "in the urine". More recently, investigation in cattle and water buffaloes conducted by Manresa and Gonzalez (1936) showed that smears taken from all important organs of the animals with heavy peripheral infection at the time of killing, invariably showed the presence of surra organisms in the heart, liver, spleen and lungs. In other cases, however, the results were variable.

On the other hand, there are some investigators who differ with the general statement given above. They believe the parasites to be more numerous in certain organs, such as the lymphatic glands and the bone marrow, than in others. The results of the investigations of Schelling (1901) disclose that *Trypanosoma evansi* was not found in the spleen when it was present in the peripheral blood, and that the trypanosomes might be absent from the fluids and tissues but was constantly present in the bone marrow. The peritoneal exudate and bone marrow showed the parasites in the "budding form". The number of trypanosomes in the spleen varied greatly. The conclusion was drawn that the parasite undergoes multiplication in certain organs, while it is destroyed in others. Martini (1903) regards the spleen, lymphatics, bone marrow, and, to a less extent, the liver and the kidneys as the sites for the destruction of trypanosomes.

Citing the findings of Yorke (1911), Wolback and Binger (1912), and Stephenson (1922), Craig and Faust (1937) state that in African sleeping sickness, *T. gambiense* is found in the blood and lymphatic glands during the early or febrile stage of the disease. After the development of nervous symptoms the organism is found in the cerebrospinal fluid. It does not live within the tissue cells but may be found in the connective tissue spaces of the various organs and in the reticular tissue of the lymph nodes and spleen. It may be found in the intercellular spaces in the brain and is present in large numbers in the lymph channels throughout the body. Yutuc (1934) has demonstrated the presence of *T. evansi* after its prepatent period in the cerebrospinal fluid of horses by subinoculation and microscopic examination as early as five days and as late as twenty two days with an average of twelve days in ten out of seventeen animals.

In view of the divergent findings of the investigators cited in the foregoing, the present work was conducted with the following objects: First, to determine the distribution of surra trypanosomes in the body of rats during the prepatent period; Second, to estimate the degree of trypanosome density in various organs as well as in the blood during the patent period; Third, to determine whether or not the trypanosomes tend to appear in considerable numbers in some internal organs during periods when they can not be seen by the microscope in the peripheral blood (subpatent period) of guinea pigs.

MATERIALS AND METHODS

Animals used.—White and piebald rats and guinea pigs were employed in the investigation. The rats and a number of guinea pigs were obtained from the rat and guinea pig colonies of the Department of Bacteriology and Pathology, College of Veterinary Science, University of the Philippines, Pandacan, Manila. The rest of the guinea pigs came from the stock kept in the Department of Veterinary Medicine which have been raised from a single pair secured from the Institute of Hygiene, University of the Philippines.

Animal care.—The rats and guinea pigs were kept in galvanized iron cages with movable pans. All pans were cleaned once a week. The animals were supplied with abundant feed consisting of copra meal and first class rice bran. Green forage, mostly guinea grass was given in unlimited amount. Clean tap water for drinking was accessible all the time.

Strain of trypanosome used.—The organism, *Trypanosoma evansi* (Steel, 1885) used was recovered July 23, 1946 by subinoculation into a guinea pig from a water buffalo suffering from surra kept for sometime in the animal shed of the Bureau of Animal Industry, Pandacan. The organism has been maintained in the laboratory by continued passing through guinea pigs at appropriate interval.

Procedure employed.—In the first series of rats used in the study of the pre-patent period, infected blood was taken from the marginal ear vein of a guinea pig suffering from surra. The blood was aspirated in a one-cubic-centimeter syringe containing physiological saline solution to which a small amount of sodium citrate was added to prevent coagulation. One fifth cubic centimeter was inoculated subcutaneously into each rat. Inoculations of subsequent series of rats were made from

the heart blood of the infected rats killed in the course of the study. Before the parasite appeared in the peripheral blood, the rats were killed with chloroform. On autopsy impression smears of the important solid organs of the body were made; viz.—bone marrow, heart, liver, lungs, brain, kidneys, spinal cord and precural lymph glands. Occasionally other organs were included as may be noted elsewhere in this paper. In the process of posting the animals, care was taken in using clean instruments to avoid contamination of the smear of one organ with that of another. The average time consumed in the preparation of smears was approximately one half hour.

The smears were dried and fixed in air. The preparations were then immediately stained with Wright's stain and dried. Each slide was examined microscopically for surra organism. At least fifty microscopic fields were examined and the average per field computed.

In the study of the patent period the course of the disease was allowed to progress until the trypanosomes could be demonstrated by microscopic examination of the tail blood. In most instances the rats were bled to death or chloroformed when the blood was teeming with the causative agent. In the case of the subpatent period, the guinea pigs were the animals of choice, because of their resistance to surra trypanosome. The course of the infection is of a relapsing type, the guinea pig dying as a rule after a number of relapses, hence appropriate for this study. In the preparation of the smears, the same routine was observed as the prepatent period of work.

In the evaluation of the findings, the following key was employed:

0 = No trypanosome in 50 microscopic fields
\+ = Less than one trypanosome per microscopic field
2+ = From one to five trypanosome per mocroscopic field
3+ = From 5 to 30 trypanosomes per microscopic field
4+ = Over 30 trypanosomes per microscopic field

RESULTS AND DISCUSSION

Prepatent period.—Table 1 shows that among the organs consistently examined for trypanosomes only the bone marrow failed to yield the organism, while the brain, heart, kidneys, and spleen showed the parasite once, the liver twice and the lungs three times.

In the case of the other organs, which were sporadically examined, the organism was never demonstrated microscopically. The data presented indicate that during the prepatent period the organism is also scarcely seen in the various solid organs examined. This agrees with the finding of Voges (1901) that the whole cycle of *T. equinum,* the causative agent of "mal de caderas," takes place in the blood of the vertebrate host. The occasional finding of the trypanosome in the organs examined can not be interpreted to mean that the parasites multiply and accumulate in considerable number in the internal organs during the initial period of the infection. Further, the morphological studies of the few organisms encountered did not show the presence of dividing forms.

TABLE 1.—*Distribution of trypanosomes in the body of rats during pre-patent period of the infection*

Organs examined	Rat number													
	1	2	3	4	5	6	7[a]	8	9	10	11	12	13	14
Adrenals	----	0	0	0	0	0	----	----	----	0	----	0	0	0
Brain	0	0	0	0	0	+	----	0	0	0	0	0	0	0
Bone marrow	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Heart	+	0	0	0	0	0	0	0	0	0	0	0	0	0
Kidneys	+	0	0	0	0	0	0	0	0	0	0	0	0	0
Liver	+	0	0	0	0	0	0	0	0	0	0	0	+	0
Lungs	+	+	0	0	0	0	0	0	0	0	0	0	+	0
Pancreas	----	0	0	----	----	0	----	----	----	----	0	0	0	0
Spleen	0	0	+	0	0	0	0	0	0	0	0	0	0	0
Lymph gland	----	----	----	----	----	----	----	----	0	0	0	0	0	0
	2	1	1	1	1	1	1	4 hrs.	5 hrs.	1	1	3	3	3
	Days killed after infection													

[a] Mouse

Patent period.—In the first series of rats as shown in Table 2, the animals were bled to death at the height of the infection, that is when the peripheral blood was teeming with trypanosomes. Since it was impossible to examine all the animals at the same time, some of the killed rats had to be kept in the refrigerator for as long as two days. The distribution of the surra organisms appears decidedly different in the various organs examined. The heart and liver consistently showed heavy trypanosome burdens ranging from 2+ to 4+ in the former and 3+ to 4+ in the latter. The kidneys and the lungs come next with a trypanosome density of + to 4+. In general, the brain, bone marrow, and the spleen showed light trypanosome contents (0 to +). It is apparent from these findings that the

more vascular the organ the heavier is the trypanosomes density. The observation of Musgrave and Clegg (1903) that the surra organisms are usually somewhat more numerous in the spleen, liver and lymphatic glands than in the bone marrow is therefore not entirely confirmed.

TABLE 2.—*Distribution of trypanosomes in the body of rats at the height of infection*

Organs examined	Rat number									
	1	2	3	4	5	6	7	8	9[a]	10
Bone marrow	0	0	0	0	0	+	+	-----	0	+
Brain	+	0	0	+	+	+	+	+	3+	+
Heart	4+	4+	4+	4+	4+	3+	2+	3+	4+	4+
Kidneys	4+	+	+	2+	+	2+	3+	2+	3+	2+
Liver	4+	3+	3+	4+	3+	3+	3+	3+	4+	3+
Lungs	2+	+	+	+	3+	4+	4+	2+	4+	2+
Spleen	+	+	0	0	0	+	+	+	+	+
	0	1	1	1	2	0	0	0	0	0
	Days killed after infection									

[a] Mouse

Since, the animals used in the above experiment were killed by bleeding, the results obtained are to a certain degree questionable. To rule out the possible influence of bleeding in the natural distribution of the parasites in the various organs, another series of rats was infected at various intervals and killed with chloroform inhalation. The impression smears of these animals were made, stained and examined the day they were prepared. The majority of the rats used, were killed at the time the tail blood was swarming with trypanosomes (3+ to 4+ per microscopic field) as shown in Table 3. A perusal of the results presented in the above cited table one will note that the lung, liver, heart and kidneys grouped together bear an almost identical trypanosome burden per microscopic field as that of the tail blood, the range being 3+ to 4+ for both. Comparing the above organs with the rest, there is a decided heavier concentration of the organisms in the lungs, liver, heart and kidney than in the brain, spleen, bone marrow and lymph glands (rats 2 to 5 and 11 to 20). A comparative study of tables 2 and 3 will show that no such decided change in the intensity distribution of the trypanosome has taken place in the lungs, liver, heart and kidneys as a result of bleeding beyond a slight degree in the kidneys and lungs. However, in the case of the bone marrow, brain and spleen the change in the

density is quite marked. In some of the rats that were killed when the tail blood was lightly infected with trypanosomes (Table 3, rats Nos. 1, 2, 8, 9, and 10) the parasite burden of the peripheral blood is almost the same as that in the heart, liver, lungs and kidneys. Indirectly, these five rats serve to bridge the gap between the prepatent period and the patent period of maximum trypanosome density in the peripheral blood. Again the brain, spleen and bone marrow carry a correspondingly lighter trypanosome burden than the peripheral blood.

The above data present an added weight to the statement that the more blood the organ contains the more parasites it harbors. The liver, heart, kidneys and lungs being more vascular than the rest of the organs studied, therefore, presented the heaviest trypanosome density at least in an animal where the resistance is low as in the case of rats. The density of the organisms in the peripheral blood is almost identical with that in the liver, heart, kidneys and lungs but decidedly heavier than the trypanosome density of the spleen, brain, bone marrow and lymph glands. In this case, it is erroneous to subscribe fully to the statement that the parasites are evenly distributed in the various organs of the body. Further, the low density of the trypanosomes in the bone marrow, spleen, and lymph tissues may be attributed to the statement of Martini (1903) who states that these organs, constituting the great bulk of the reticulo-endothelial systems, are quite active in the destruction of the organisms.

TABLE 3.—*Distribution of trypanosomes in the body of rats during the patent period*

Organs examined	Rat number									
	1	2	3	4	5	6	7	8	9	10
Bone marrow	+	0	2+	+	+	2+	0	0	0	0
Brain	0	2+	2+	2+	3+	2+	0	0	+	+
Heart	+	4+	4+	3+	3+	3+	+	2+	2+	2+
Kidneys	+	4+	4+	3+	3+	4+	+	+	2+	2+
Liver	+	4+	4+	3+	3+	4+	+	+	2+	2+
Lungs	+	4+	4+	3+	3+	4+	+	+	2+	2+
Spleen	0	4+	2+	2+	3+	2+	0	0	+	2+
Lymph gland	-----	+	0	0	-----	-----	-----	-----	-----	-----
Tail blood	+	4+	4+	4+	4+	4+	+	+	2+	2+
	3	4	4	6	6	7	6	8	6	5
	Days killed after infection									

TABLE 3.—*Distribution of trypanosomes in the body of rats during the patent period*—Continued

Organs examined	Rat number									
	11	12	13	14	15	16	17	18	19	20
Bone marrow	+	+	2+	+	+	2+	+	+	+	0
Brain	+	2+	2+	2+	2+	+	2+	2+	+	+
Heart	3+	3+	3+	3+	3+	3+	3+	3+	4+	3+
Kidneys	4+	3+	3+	3+	3+	3+	4+	3+	4+	2+
Liver	4+	3+	4+	3+	3+	3+	4+	4+	4+	3+
Lungs	4+	3+	4+	3+	3+	3+	4+	4+	3+	3+
Spleen	3+	+	2+	+	3+	2+	2+	+	2+	+
Lymph gland		0								
Tail blood	4+	3+	3+	3+	4+	3+	3+	4+	3+	3+
	5	8	6	6	8	9	10	5	6	4
	Days killed after infection									

Subpatent period.—In the subpatent period study, guinea pigs were killed as early as fourteen days and as late as one hundred and eighty-four days after infective inoculation of surra blood (Table 4). The picture of trypanosome distribution is quite different from the rats. Relative to the frequency of the microscopic finding of the trypanosome in the organs examined, the brain, and the lymph glands show the parasites eight times out of the fifteen guinea pigs thus far employed in the investigation. The spinal cord comes next with four positive results out of the numbers used; kidney and liver 3 times and the bone marrow and spleen 2 times; and in the lungs and heart the organism was only noted once. In the adrenals the trypanosome was noted two times in the six cases that this organ was examined. In regards to the density, although quite variable in the same organ of the different animals of the species, the brain tissue demonstrated the heaviest density of trypanosome its maximum being 3+ and the minimum +. Taking the animals as a whole it will be noted that the organism was noted in all organs examined. For comparative study a number of guinea pigs with positive peripheral blood (+) were killed and distribution studied. The brain and lymph glands showed the heaviest density, the former being 3+, the latter 2+. The rest of the organs gave almost the same intensity as the surface blood. In discussing the results of this series, at least in the organs consistently used, the general statement "the more vascular the organ, the heavier is the trypanosome density and that the trypanosome

density of the peripheral blood is directly proportional to the density of the organisms of the vascular organs given in the rats" does not seem to fit in with the results obtained in the guinea pigs. Further, the brain, lymph glands and the spinal cord are certainly less vascular than the heart, liver, kidneys and lungs, yet the burden of trypanosomes is significantly heavier in the former than in the latter. In the guinea pig the organism has the strongest affinity to settle in greater number in the nervous tissue than the rest of the organs both in patent and subpatent periods. To elucidate the different findings between the rats on one hand and the guinea pigs on the other, one has to look into the differences in the resistance of the two animals to surra infection and the course of the disease when the animals were killed. In this particular instance the rat represents a susceptible animal whereas the guinea pig a resistant subject. In fact, Tubangui and Yutuc (1931) stated that a varying degree of resistance is exhibited by different species of surra animals. This is indicated by their ability to keep in abeyance for a shorter or a longer period of time the rapid and permanent proliferation of the surra trypanosomes. Thus, on the one hand the rat possesses a low type of resistance for, in this animal the infection runs an acute progressive course, the parasite undergoing a constant increase in number and death taking place when the number of the parasites in the blood has reached a miximum level. The guinea pig, on the other hand, possesses a high type of resistance, for in this animal the infection follows a chronic relapsing course and death usually occurs when the parasites are scarce in the circulation. *In vitro* study of the sera of rats and guinea pigs infected with surra organisms Kligler (1931) demonstrated trypanolysin in the guinea pigs but not in rats. In the latter no lysin existed at any stage of trypanosome infection. As a result of splenectomy studies in rats, the main defense has been found to be a cellular one in this species. These lytic bodies in the guinea pig and other resistant species have also been repeatedly demonstrated by a number of investigators *in vivo* studies (Diesing, 1908; Kleine and Mollers, 1906; Taliaferro, and Johnson, 1926). It is probable that this resistance in the guinea pig induced the trypanosome to localize in less vascular organs such as the brain, spinal cord and the lymph glands when the peripheral blood was negative in microscopic examination.

TABLE 4.—*Distribution of surra trypanosomes in the body of guinea pigs during subpatent period*

Organs examined	Guinea pig number														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Adrenals	+	0	----	----	+	----	----	----	----	----	----	----	0	0	0
Bone marrow	+	0	0	0	+	0	0	0	0	0	0	0	0	0	0
Brain	0	3+	0	3+	0	+	0	0	0	+	+	+	0	+	+
Heart	0	0	+	0	0	0	0	0	0	0	0	0	0	0	0
Kidneys	+	0	0	+	+	0	0	0	0	0	0	0	0	0	0
Liver	+	0	0	+	+	0	0	0	0	0	0	0	0	0	0
Lymph glands	+	2+	+	+	+	0	0	0	0	0	+	0	0	+	+
Lungs	0	+	0	0	0	0	0	0	0	0	0	0	0	0	0
Spleen	+	0	0	0	+	0	0	0	0	0	0	0	0	0	0
Spinal cord	----	+	+	2+	----	+	0	0	0	0	0	0	0	0	0
		184	173	87	14	17	14	16	17	17	51	52	18	123	83
	Days killed after infection														

SUMMARY AND CONCLUSIONS

An inquiry into the distribution of *Trypanosoma evansi* (Steel, 1885) in the body of rats and guinea pigs was performed. It has been found that in rats during the prepatent period the organisms are scarce in the internal organs such as the bone marrow, brain, heart, kidneys, liver, lungs, spleen and lymph glands. No indication tending to suggest that the organisms multiply and accumulate in considerable number in the organs examined during the initial period was found. During the patent period there seems to be a direct relationship between the density of the trypanosomes in the peripheral blood and in the heart, liver, lungs, and kidneys. In the spleen, brain, bone marrow and lymph glands, the distribution intensity is lower than in the peripheral blood. While bleeding has little or no effect on the distribution of the organisms in the liver, heart, lungs and kidneys, a significant decrease in the bone marrow, brain and spleen was recorded. During the subpatent period in guinea pigs the brain, lymph glands and the spinal cord which have light trypanosome burdens during patent period, presented a comparatively heavier trypanosomes density. The resistance of the animal to the infection may possibly be the factor responsible for this finding. The statement that the organisms are evenly distributed in the different organs of the body was not sustained and that the multiplication of the trypanosome takes place in the body fluids seems justified.

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ADVERBS AND PREPOSITIONS IN ILOKO

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CHAPTER I: THE ADVERB

I. GENERAL REMARKS

A great many adverbs are expressed in Iloko by simple adjectives; by substantives, adjectives, and so on, in the oblique; by verbs with an adverbial meaning; and by substantives, verbs, and so on, with adverbial prefixes, infixes or suffixes, or with adverbial reduplications.

Many of these forms are found scattered about in former publications, under different headings. To be more or less complete and to supply as much as possible all omissions, I shall give the following list, which may serve at the same time as a recapitulation. Later on I shall study some of the most used adverbs and adverbial expressions in particular.

I. Adjectives used as adverbs. Examples:

nadarás ti pannagnána	he walks quickly.
nainayad ti panaggunáyyo	you move slowly.
napintás ti panagabélda	they weave nicely.
naalás ti panagsaóda	they speak unbecomingly.
nalaíñg ti panagsarítam	you speak fluently.
nagagét ñga agsursúro	he studies diligently.
nasadútkayo ñga agsúrat	you are lazy writers (you write lazily).
naúyoñg a mañgisúro	he is a severe teacher (he teaches severely).

II. The oblique taken adverbially. Examples:

mapánkayo ití rumabií	go at nightfall.
mapán ití masansán	he often goes.
immáykami ití rabií	we came in the evening.
agsublíkayo ití bigát	come back in the morning.
mañgán ití mabayág	he eats long.
madúsadanto ití agnanáyon	they will be punished eternally.
simmañgpet ití ñgálay ti rabií	he arrived at midnight.
pumánawkami ití apagbiít	we go away for a while.
napán ití sunoén daydí a láwas	he went the following week.
ití naminsán ñga aldáw	on a certain day.
ití naminsán a pananñgrabiída	once, while they had supper.

addá ití unég	he is inside.
matúrogkami ití pagbaetánda	we sleep between them.
agnaédkayo ití teñgñgána	you live in its midst.
makisarítada ití ruár	they talk outside.
nagyán ití nagseñgñgatánda	he was located between them.
immúli ití ñgátona	he climbed above.
napán ití babána	he went below.
addá ití makatigídna	it is at his left.
agsaó ití naalás	he speaks unbecomingly.
magnáka ití nadarás	walk quickly.
nagsaká́y ití naminduá	he rode twice.
agsaóda ití adú	they talk much.

III. Verbs with an adverbial meaning. Examples:

sansánem ti agluálo	pray often.
bayagénda ti agsaríta	they talk long.
sinápami ti nagbantáy	we watched early.
agteñgñgá	he is in the middle.
rumuárda	they go out.
ñgumáto	it goes up.
bumabá	it goes down.
agdamá a mañgán	he is eating just now.
ininá́yadmo ti nagná	you walked slowly.
naginá́yadda a nagtaráy	they ran slowly.
darasényo	be quick.
in-inútenda ti pumídut	they pick them up little by little.
agsiglátkami	we go fast.
dína met binayág a pinagkottóñgan	he was not long in getting thin.

IV. Adverbial prefixes, infixes and suffixes:

1. Notion of concomitance:

a. The Prefix *ka* and the combination *ka* . . . *an*. Cfr. The Substantive, III. Formation of Substantives, III, 4; The Adjectives, III. Special Forms. 1; and The verb, The Adjectival Prefix *maki*. b. II. and so on.[1]

b. The Prefix *maki*. Cfr. The Verb, The Adjectival Prefix *maki*.[2]

c. The Prefix *si*. Cfr. The Adjective, III. Special Forms. 7; The Verb, The Adjectival Prefix *ag*. b. III. A. 4; The Adjectival Prefix *ma*. b. 1. and so on.[3]

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[1] Anthropos **26** (1931) 472–473, 480–481; Philip. Jour. Sci. **69** (1939) 236.

[2] Philip. Jour. Sci. **69** (1939) 235–237.

[3] Anthropos **26** (1931) 484–485; Philip. Jour. Sci. **69** (1939) 231, 239.

d. The Prefix *tagi*. Cfr. The Verb, The Adjectival Prefix *ag*. b. III. B. 1; The Substantial Suffix *en*. b. II. 1. and so on.[4]

e. The Prefixes *sañga* and *sañgka* combined with Prefix *i*. Cfr. The Verb, The Substantial Prefix *i*. b. II. Note 6. B.[5]

2. Notion of similarity:

a. The Prefix *sinan* or *sinin* and *mara*. Cfr. The Adjective, III. Special Forms. 3; and The Verb, The Adjectival Prefix *ag*. b. III. A. 3.[6]

b. The Suffix *en* and the combination *pañg . . . en*. Cfr. The Substantive, III. Formation of Substantives. V.[7]

3. Notion of reciprocity: The infix *inn*. Cfr. The Substantive. III. Formation of Substantives. III. 6; The Verb, The Prefix *ag*. b. III. A. 2; The Prefix *maki*. b. II. 2. and so on.[8]

4. Notion of recency: The prefixes *ka, apag* and *kapag*. Cfr. The Adjective, III. Special Forms. 2.[9]

5. Notion of repetition:

a. The Infix *an*. Cfr. The Verb, The Adjectival Infix *an*, and so on,[10]

b. The Prefix *kara*. Cfr. The Verb, Prefix *kara*; Suffix *en*; Prefix *i*. B. I. 3.[11]

6. Notion of possibility: The Prefixes *maka* and *ma*. Cfr. The Verb, Prefix *maka*; Prefix *ma*. (adjectival and substantival), and so on.[12]

7. Notion of instrumentality:

a. The Prefix *pag*, and so on, and the Prefix *pa*. Cfr. The Substantive, III. Formation of Substantives. VI; The Verb, Substantives with Verbal Notions, and so on.[13]

b. The Prefix *i*. Cfr. The Verb, Prefix *i*.[14]

8. Notion of being of less importance: The Infix *um*. Cfr. The Verb, The Infix *um*; Verbs Implying Order or Permission, *pa . . . en*[15]

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[4] Philip. Jour. Sci. **69** (1939) 231; **71** (1940) 12.
[5] Philip. Jour. Sci. **71** (1940) 20.
[6] Anthropos **26** (1931) 482–483; Philip. Jour. Sci. **69** (1939) 231
[7] Anthropos **26** (1931) 474–475.
[8] Anthropos **26** (1931) 473–474; Philip. Jour. Sci. **69** (1939) 230–231, 236–237.
[9] Anthropos **26** (1931) 481–482.
[10] Philip. Jour. Sci. **69** (1939) 241–242.
[11] Philip. Jour. Sci. **69** (1939) 240–241; **71** (1940) 12, 17–18.
[12] Philip. Jour. Sci. **69** (1939) 233–235, 239–240; **72** (1940) 429–440.
[13] Anthropos **26** (1931) 475; Philip. Jour. Sci. **69** (1939) 247–249.
[14] Philip. Jour. Sci. **71** (1940) 15–20.
[15] Philip. Jour. Sci. **69** (1939) 232–233, **71** (1940) 30–31.

9. Notion of quantity or quality: The Prefixes *nag, naka, sumañgka,* and the Combinations *nai . . . an* and *nain . . . an.* Cfr. The Adjectives, II. Comparatives and Superlatives, passim. [16]

10. Pretending to be so: The complex prefix *agin.* Cfr. The Verb, Prefix *ag.* b. III. B. 2. and so on.[17]

11. Almost: The combinations of the prefixes *tagi, tari, ari,* and *arin* with the suffixes *an* and *en.* Cfr. The Verb, The Adjectival Combinations with *tari,* etc. [18]

12. Locative:

a. The Suffix *an,* Cfr. The Substantive, III. Formation of Substantives, III. 3; IV; The Verb, Substantive with Verbal Notions; The Substantival Suffix *an*; The Prefix *ma.* II. Note 18. a. and so on. [19]

b. The Prefixes *i* and *ipa.* Cfr. The Verb, Prefix *i*; Prefix *ipa,* and so on. [20]

c. The combination *pakin. . . . en.* Cfr. The Verb, Prefix *ipa.* A. 3. Note 7.[21]

d. The terms *addá* and *awán.* Cfr. To have and to be.[22]

13. Frequentative: Cfr. The Verb, Frequentative Prefixes.[23]

14. How and when, where, why and to whom: Cfr. The Verb, Substantive with Verbal Notions.[24]

15. Ordinal numbers, multiplicatives, distributives, indefinite numbers, fractional numbers:

a. Cfr. The Number, II, III, IV, and V; The Verb, Suffix *en.* b. II. 3. and so on. [25]

b. The combination *pi . . . en* or *pin . . . en* and the Prefixes *ipi* or *ipin* and *ikapi* or *ikapin.* Cfr. The Verb Combination *pi . . . en,* and so on.[26]

16. Reaching a certain part of the body: The Prefixes *aga* and *paga.* Cfr. The Verb, The Adjectival Prefix *aga.* [27]

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[16] Anthropos **26** (1931) 477–479.
[17] Philip. Jour. Sci. **69** (1939) 231–232.
[18] Philip. Jour. Sci. **69** (1939) 245.
[19] Anthropos **62** (1931) 472, 474; Philip. Jour. Sci. **69** (1939) 247, 250–253; **71** (1940) 12–15; **72** (1940) 439.
[20] Philip. Jour. Sci. **71** (1940) 15–22.
[21] Philip. Jour. Sci. **71** (1938) 21.
[22] Philip. Jour. Sci. **66** (1938) 417–431.
[23] Philip. Jour .Sci. **69** (1939) 245–247.
[24] Philip. Jour. Sci. **69** (1939) 247–248, 250–255.
[25] Anthropos **28** (1933) 714–720; Philip. Jour. Sci. **71** (1940) 12.
[26] Philip. Jour. Sci. **71** (1940) 23–24.
[27] Philip. Jour. Sci. **69** (1939) 242–243.

V. Adverbial reduplications:

1. Notion of easiness, and so on: reduplication of the first open syllable. Cfr. The Verb, Reduplication of Verbal Stems, passim. [28]

2. Notion of reciprocity, rivalry, repetition, and so on: reduplication of two or more syllables. Cfr. The Substantive, III. Formation of Substantives. III. 6; The Verb, Prefix *ag*. b. III. A. 2, Prefix *maki*. b. II. 2; Reduplication of Verbal Stems, passim. [29]

3. Notion of similarity and so on: reduplication of the first open syllable with the next consonant if there is any. Cfr. The Adjective, Special Forms. 3; The Verb, Prefix *ag*. b. III. A. 3; and so on. [30]

II. ADVERBS OF TIME

I. 1. The ordinary simple adverbs of time are:

a. For the present: *itá* and *itattá* (reduplication form, the initial *i* being replaced by the ligature *t*.). Examples:

addáda itá	this time they are here.
sadín ti papanányo itá	where do you go at this time?
inkayo itattá	go now directly.
ínkami mañgáyo itattá	we go to gather wood presently

b. For the past: implying a near past: *itáy* and *itattáy* reduplicated form); implying a more or less distant past: *idi*. Examples:

immáy itáy	he came just now
nagsañgit itáy	he cried just now.
addáda itattáy	they were here a short while ago.
sañgsañgpétna itattáy	he has just come home a little while ago.
natáy idí	he was dead at the time.
pimmánaw idí	he was gone then.
nagsakítak idít ta	then I got sick there.

NOTE 1. In ordinary conversation, when *itáy* and *idí* follow another word, their initial *i* is very often replaced by the ligature *t*, especially when the other word ends in a vowel. Examples:

Sikát tay (for: *Sika itáy*)	it was you just now.
isútdi (for: *isú idí*)	it was he at the time.

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[28] Philip. Jour. Sci. **75** (1941) 207–211.

[29] Anthropos **26** (1931) 473–474; Philip. Jour. Sci. **69** (1939) 230–231, 236–237; **75** (1941) 207–211.

[30] Anthropos **26** (1931) 482; Philip. Jour. Sci. **69** (1939) 231; **75** (1941) 207–211.

2. Complex adverbs of time are formed by the addition of a substantive (either alone or accompanied by a qualifying word), an adjective, and so on, to:

a. The demonstrative *itóy* or *itá* (preceding, ligature *a* or *ñga*), for the present. Examples:

itóy ñga aldáw	today.
itóy a bigát	this morning.
itóy a búlan	this month.
itá ñga aldáw	today.
itá a malém	this afternoon.
itá a rabií	this evening.
itá a nasápa	now as it is early.
itá a naládaw	now as it is late

NOTE 2. *Itóy* may follow immediately, but then the article precedes the substantive, and so on. Examples:

itáy aldáw itóy	today.

b. The demonstrative *itáy* or *idí*, rarely *idiay* (no ligature), for the past. Examples:

itáy agsápa	early this morning.
itáy malém	this afternoon.
itáy kuá	a while ago.
itáy parbáñgon	this morning very early.
itáy napán a tawén	last year.
itáy kallabés a tawén	last year.
idí kalmán	yesterday.
idí rabií	last night.
idí malém kalmán	yesterday afternoon.
idí bigát kalmán	yesterday morning.
idí kallabés ti talló a búlan	three months ago.
idí napán a tawén	last year.
idí maikatló a tawén	three years ago.
idí kuá	then.
idí nabayág	long ago.
idí naminsán ñga aldáw	the day before yesterday.
idí (ka) sañgaaldáw	the day before last.
idí kasañgatawén	the year before last.
idí katimmawén	three years ago.
idiáy nakabutbutéñg ñga aldáw	on that terrible day.

c. The conjunction *intóno, no, tóno* (ordinary forms), *attóno, antóno* (rarely used), for the future. Examples:

intóno bigát	tomorrow.
bigát no bigát	tomorrow morning.
malém no bigát	tomorrow afternoon.
tóno malém	this afternoon.

attóno aldáw	later on in the day.
antóno rabii	this evening.
no rabii	this evening.
(in)tóno kuá	then.
intóno mabayág	much later.
intóno umáy a búlan	next months.
intóno maikapát a búlan	after four month.
intóno malábes ti uppát a bulan	after four months.
intóno arinúnos ti búlan	at the end of the month.
intóno saŋgatawén	after two years.
intóno saŋgaaldáw	the day after tomorrow.
intóno saŋgaaldáw a maysá	after three days.

NOTE 3. When these adverbs of time follow the verb, no ligature connects the two. Examples:

umáyka itóy ŋga aldaw	come today
agáladkami itóy ŋga aldáw	we make a fence today.
napánda itáy aldáw	they went about midday.
sinurónnakami itáy agsápa	he teased us early this morning.
kasaŋgsaŋgpétda itáy malém	they just came home this afternoon.
nagtálawda idí rabii	they escaped last night.
inádalko idí nabayág	I learned it long ago.
immáy idí aldáw kalnán	he came yesterday about midday.
mapánto no bigát	he will go tomorrow
matáyto no mabiít	he will die soon.
mapánkami intóno agsápa	we shall go early tomorrow.
umáyak no kuá	I shall come later.
sumaŋgpet intóno kuá	he will arrive later.

NOTE 4. The term *agdamá* may be used to indicate the present; when used in the past (*nagdamá*), it indicates concurrence of events. Examples:

agdamá a maŋgán	he is eating presently.
agdamáda ŋga agsursúrat	they are writing just now.
nagdamáda a nagsáŋgit idí	they were crying at the time.
ití agdamá a búlan	the current month.
ití agdamá a tawén	the current year.
ití tawén ŋga agdamá	the current year.

NOTE 5. The combination *ka . . . an* (past *kina . . . an*) adds the notion of "the following" to the substantive which indicate the period of time. Examples:

ití kabigatánna	the next day.
idí karabiián ti isasaŋgpetko	the evening after I came home.
intóno kabigatánna	the next day (future).
idí kinabigatán ti daydí aldáw	the next day (past).

II. To indicate that something is done every day, every month, and so on:

1. The infix *in* is joined to the stem. Examples:

inaldáw	every day.
binigát	every morning.
rinabií	every evening.
umáy ití binulán	he comes every month.
tinawén ti panagsakítko	I am ill every year.

2. The term *patináyon* or (*kan*) *kanáyon* is connected with the noun by *a* or *ñga*. Examples:

patináyon ñga aldáw	every day
patináyon a búlan	every month.
kanáyon a bigát	every morning.
kankanáyon a malém	every afternoon.

NOTE 6. When the infix *in* is joined to the stem and its first two syllables are reduplicated besides, the recurrence of the event is emphasized. Examples:

inaldaw-aldáw	day by day.
binigatbigát	every morning without fail.
rinabirabií	every evening without fail.
tinawentawén	every year without fail.

III. The prefix *maka* (past: *naka*) joined to the substantive which indicates the period of time, means that something lasts once the duration implied by the substantive. If the duration is longer, the Iloko connect the number with the substantive, followed by a possessive pronoun, by the ligature *a* or *ñga*. Examples:

makabúlankayonto idiáy	you will stay there a month.
nakatawénda idiáy babá	they stayed a year in the lowlands.
duá ñga aldáwmi idiáy	we stayed there two days.
duá púlo ñga aldáwtayo idiáy kabakíran	we stayed twenty days in the forest.
sañgapúlo a tawénmi idiáy	we stayed there ten years.

NOTE 7. *Agpatnág* (past: *nagpatnág*), from the complex prefix *agpa* and the stem *tinnág*, means: the whole night; *agmalmalem* (past: *nagmalmalem*) means: the whole day. Examples:

agpatnág ñga agsursúrat	he passes the night writing.
nagpatnágkayo a nagsugsugál	you spent the whole night gambling.
agmalmalémda ñga agsañgsañgit	they weep the whole day.
nagmalmalémkami a nagnagná	we walked the whole day.

NOTE 8. Sometimes the prefixes *maka* and *makanika* (past: *naka* and *nakanika*) are joined to the cardinal numbers in the same way as the prefix *maiká* (of ordinal numbers), to indicate a period of days. The prefix *maka*

may also be joined to the distributives with the same meaning. "One day" is *makaysa* (past: *nakaysa*). The corresponding interrogatives are: *makamanó* and *makasagmamanó*. If the period is not a number of days, but a number of months, and so on, this must be expressed in the sentence. These forms, however, are used very rarely. Examples:

makatlódanto ñga agyán idiáy	they will stay there three days.
makamanókayo ditóy	how many days do you stay here?
makanikatló púlokami ket duá	we shall stay twenty-two days.
makaysádanto	they will stay one day.
makapátda idiáy	they stay there four days.
makasagwawalókamto	we shall stay eight days.
makapát a tawén ditóy	he stays here four years.

NOTE 9. *Makamanó* and *makamanmanó* (rarely used) mean: a long time, much time, difficult. Examples:

saán a makamanó daytá ñga arámid	that work is easy.
makamanmanóka a baonén	it is very hard to send you somewhere.

IV. A peculiar adverb of time is *en* which is often joined to the last word of the sentence and means: already, now, and so on. We saw one of its many uses when treating the comparatives and superlatives of adjectives,[31] and we shall see another one in the disintegration of the adverb *manén* "again." [32] Cfr. also Phonology, VI Syncopations. II. B. c. and IV. B. 1.[33] Examples:

addán	here he is now.
umáykan	come along now.
simmañgpéten	he has arrived already.
nakadánon ti lakáyen	the old man got there already.
siákon	it is my turn now.
aláemon	all right, take it now.
mayátakon	I am willling now.
kuákon	now it is mine.
kitáem ti bakéten	look at the old woman now.
addá mettén	here he is now though.
madíkamin	we don't want it any more.
addá ñga agtaráyen	there he is running now.
nagtálawsa met ti ásomon	your dog escaped already, didn't he?
inayátnan	she loved him already.
madamán	he is at it.
idí kuán	and then at the time.
bumáñgonkayon	arise now.

[31] Anthropos 26 (1931) 479.
[32] See below: VI. Adverbs of Quality and Manner, IV. 13.
[33] Anthropos 23 (1928) 1936, 1940.

mañggapón ñga agbannáwag	it begins to dawn already.
anián, daytóyen	what now, what is the matter with this one?
isúnan	stop it now; it is enough now.
konák lən nalaklakáda	I thought though that they were cheaper.
awánen	there is no more; he is not here any more; it is done for.
saán ñgamínen ayá ñga agsursúrat	well, indeed, is he not writing any more now?
anía ketdín ayá	stop it, what is the matter there? (annoyance)
	what can be done? (resignation)

V. Other adverbs of time:

1. *Patináyon,* (*kan*) *kanáyon* and *agnanáyon:* "always". Examples:

agluálo a patináyon	he always prays.
patináyonda ñga agsáñgit	they always weep.
patináyon ñga agrabrábak	he is always jesting.
kankanáyon a tumaráy	he always runs.
agbasbása a kankanáyon	he is always reading.
kankanyon láeñg a nagtalinaédda ití kappiá	they always remained in peace.
kanáyon ñga agdáwat	he always asks for things.
kastá a kanáyon	it is always so.
naragsákda ñga agnanáyon	they are always full of joy.
madúsada iti agnanáyon	they are punished eternally.

2. *Masansán:* (past: *nasansán*), *mamin-adú* (past: *namin-adú* and *nasarantá:* "often." Examples:

masansán ñga umáy	he often comes.
masansán a sasaoénna	he often says so.
masansán ti panagkatáwana	he often laughs.
agsáñgit ití masansán	he often weeps.
agladiñgit a masansán	he often grieves.
mamin-adú ñga agbarték	he often gets drunk.
namin-adú a naguñgét	he often was angry.
kimmagát ití namin-adú	he often bit.
nasaránta ti panagdáwatna	he often asks for things.

3. *No daddúma:* "sometimes" (no ligature). Examples:

immáy no daddúma	sometimes he came.
no daddúma agsáñgit	sometimes he weeps.
mañgánkami no daddúma ití tinápay	sometimes we eat bread.
no daddúma napánkami idiáy Bañgár	sometimes we went to Bangar.

4. *Sagpaminsán:* "now and then." Examples:

mañgálakami ití sagpaminsán	we take some now and then.
umáy no sagpaminsán	he comes now and then.
sagpaminsán ti yaáymi	we come now and then.
sagpaminsán ñga agbarték	he gets drunk now and then.

5. (*Pas*) *pasaráy*: "occasionally" (preceding). Examples:

paspasaráy umáy	he comes occasionally.
pasaráy nagbarték	he got drunk occasionally.
pasaráyda tumaliáw	they look back occasionally.

6. *Ñganiñgáni* and *dandaní*: "nearly, almost", and so on (preceding, no ligature). Examples:

ñgañgánika saplíten	I shall soon whip you.
ñganñgáni rabíien	it is almost evening already.
dandaní pumánaw	he is near going.
dandaní a las dos	it is nearly two o'clock.
dandaní ni ulitégko itán	my uncle is almost here now.

7. *Madamdama:* "soon." Examples:

sumañgpét no madamdamá	he will arrive soon.
no madamdamá umáyak	I shall come soon.
ití madamdamá bassít	a little later.

8. *Bíit* and *bassít*: entreating; "literally for a moment" (following, no ligature). Examples:

sumrékka bíit	come in for a moment.
ínka bassít idiáy Sánta	go once to Santa.
ínka bassít aláen ti súratko	please, go to take my letters.

III. ADVERBS OF PLACE

I. The three simple adverbs of place, corresponding to the three demonstratives, are:

Complete form		Abbreviated form	Corresponds to
ditóy	(here)	*toy*	*daytóy* (this)
ditá	(there)	*ta*	*daytá* (that)
idiáy, sadiáy	(there)	*diáy*	*daydiáy* (that)

addákam ditóy	we are here.
simmañgpet ditóy	he arrived here.
madí a mañgán ditóy	he won't eat here.
addá masakít ditóy	is there anyone sick here?
nañgasáwa ditóy	he married here.
ditóy nakatayánna	he died here.
adú ti bagás ditóy baláymi	there is much rice in our house here.
ti kúkua ditóy lúboñg	the earthly goods.
umáykat toy	come here.

awán toy ti kayátko	what I want is not here.
isú ti addát toy	it is he who is here.
awán ti mayát toy	nobody is willing here.
isú ti nakiasáwa kenkuánat toy	she married him here.
awán ditá	it is not there.
madída ámin ditá	do they all refuse there?
addá nañgála ditá	someone took it there.
ditá ti papanánda	they go there.
adú ti bagás ditá baláyyo	is there much rice in your house there?
awán ditá yánmo	it is not at your place there.
ínkat ta	go there.
addát ta ti birókek	what I look for is there.
umáyaktot ta no umimbágak	I shall come there when I get well.
no umáykamit ta aguñgétka	when we come there you are angry.
nakadánondat ta	they got there.
nagsakítak idít ta	then I got ill there.
napánkami idiáy	we went there.
madída a matúrog idiáy	they do not want to sleep there.
adú ti bagás idiáy	there is much rice there.
ínkamto gumátañg idiáy	we shall go to buy some there.
dagití ubbiñg ti napán idiáy	the children went there.
idiáy ti nakasarákanmi	we met him there.
ínkat diáy	go there.
addádat diáy	they are there.
bassít ti mayát kanót diáy	they say that few people there are willing.
isúdat diáy	there they are.
addánsat diáy ni Luís	Lewis is there, I believe.

NOTE 10. There is no difference between the use of the complete forms and that of the abbreviated ones, and, when these adverbs follow the verb and so on, (except an occasional *t*) no ligature is used to connect them all this may be seen in the above examples.

NOTE 11. *Sadiáy* refers to a place which has been alluded to before. Examples:

ínka diáy simbaán sadak urayen sadiáy	go to the church and wait for me there.
napanák idiáy Diñgrás ket sadiáy ti nakakitáak kenkuána	I went to Dingras and met him there.

NOTE 12. In some districts the Iloko use *sadí* instead of *idíay*[54]. Examples:

Sadín ti papanám?—Sadí	where do you go?—There.

NOTE 13. Sometimes *nay* is used as an adverb of place, but it is not very polite term. Examples:

nay aláem	here, take it.
ditá nay lansáñgan	there in the street.
bumallásiwka ditá nay álad	cross that fence there.

[54] See below: The Preposition, VI.

NOTE 14. *Ni* may be added to words indicating place or location, and sometimes also to other words. It more or less represents the English "see." Examples:

addát toy ni	it is here, see.
kitáem ni	look here.
awán ni	it is not here, see.
kastóy ni	like this, look.

NOTE 15. *Ditóy* may be used as a substantive including the notion of an adverb of place. Examples:

nasakít ti ditóyko	this hurts (showing where).
addá gaddíl ití ditóyna	he has itch here (showing where).

II. The following adverbial expressions sometimes occur:

adtóy or *atto'y*	Contraction: *addá* and *toy*
addaytóy (rarely used)	Contraction: *addá* and *daytóy*
addáytá	Contraction: *addá* and *daytá*
addaydiáy	Contraction: *addá* and *daydiáy*
addagitóy	Contraction: *addá* and *dagitóy*
addagitá	Contraction: *addá* and *dagitá*
addagidiáy	Contraction: *addá* and *dagidiáy*

Examples:

adtóy ti adípenmo	behold thy servant.
adtóy ni apó Juán	here is Mr. John.
adtóy a binaón ti lakáy	here he is whom the old man sent.
adtóy ti yánna	here he is.
addaytóy ti ubiñg	here is the child.
addaytá ti birókem	there is what you look for.
addaydiáy ti asínyo	there is your salt.
addagitóy kami	here we are.
addagitádan	there they are now.
addagidiáy ti ásoyo	there are your dogs.

III. To indicate the relative position of two or more objects, the prefixes *akin* or *makin* (past: *nakin*) are joined to the stem implying the position of one of the objects. Cfr. The Adjective, III. Special Forms. 4; The Verb, The Prefix *ipa*. A. II. 2. Note 7.[35] Examples:

akindáya daytóy	this is on the east side.
daydiáy ti akinrabáw	that is on the upper side.
makinkanawán ti yánna	he stands at the right.
isú ti nakinkatigíd	he was at the left.
ipánmo ití makinláud	carry it to the west side.
ti makin-unég	the inside.
ti makinruár a káyo	the wood at the outside.
addá ití makinñgato	it is uppermost.

[35] Anthropos **26** (1931) 485; Philip. Jour. Sci. **71** (1940) 21.

IV. Many adverbs of place are formed by substantives in the oblique and by the preposition *idiáy* followed by a substantive, Examples:

napánda ití ruár	they went outside.
napán ití adayó	he went far.
awánda ití unég	they are not inside.
addá ití malikudák	it is behind me.
addá ití masañgoanak	it is before me.
addáda idiáy sírok	they are below.
ínka idiáy ruár	go outside.
immulí idiáy ñgato	he climbed up; he ascended.
makadánon idiáy babá	he gets down.
nagyán idiáy teñgñgá	he stayed in the middle.
ínkayo idiáy unég	go inside.
naidissó idiáy rabáwna	it was placed on top.

IV. ADVERBS OF NEGATION

I. 1. There are two adverbs of negation: *saán* and *di*.

a. *Saán* is connected with the word it modifies by the ligature *a* or *ñga*. Examples:

saán ñga áso	it is not a dog.
saán a ni Pédro	not Peter.
saán a nasayáat	it is not good.
saán a nalagdá a baláy daytá	that is not a strong house.
saán ñga ámin	not all.
saánda a talló	they are not three.
saán a daytóy	not this.
saán a napán	he did not go.
saánka ñga immáy	you did not come.
saánda a kayát	they do not like.
saánkonto a di mapáyat	I shall certainly tread it (go there).

b. *Di* precedes it immediately without any ligature. The peculiarities connected with the use of the possessives, when *di* is followed by a substantive or a substantival verb, have been alluded to before. Cfr. The Pronoun, II. Possessives.

2. Peculiarities. I.[36] Examples:

dída gayyém	he is not their friend.
díak mapán	I do not go.
díkam kayát	we do not like it.
díkay umáy	don't go.
dídakami ayatén	they do not love us.
dína pay nalpás ti nagsaó	he had not yet finished speaking.

[36] Anthropos 28 (1933) 691–692.

3. *Saán* is the most extensively used.

Di is rarely used by itself without an accompanying pronoun, except in some expressions and in literature, but it is generally preferred to *saán* when the verb is in the imperative. Examples:

dipay la umáy	doesn't he come yet?
di naimbág daytá	is that not good?
asíno ti di agayát	who won't be glad?
sumúrot kenkuána a di agtantán	he follows him without delay.
díka mamapátay	thou shalt not kill.
díka agtákaw	thou shalt not steal.

NOTE 16. *Ammók pay* and *ammók kadí* or *ammó pay* and *ammó kadí* are strange expressions meaning "I don't know, it cannot be known".

NOTE 17. *Naymán*, "who knows?", has become antiquated.

II. "Never" is translated by adding the adverbial expressions *úray kaanó* (*man*) or *úray anó* (*man*) to a negative sentence. After *úray* may be placed: *no*, *intón* (regular forms) *adtón*, *attón* (rarely used). Examples:

díakto gatañgen úray kaanó man	I shall never buy it.
saánna a kayát úray no anó man	he never wants it.
díkamto gayyém úray no anó	he will never be our friend.
úray intón kaanó man	never.
úray anó saának pay a nañgán iti tinápay	I never ate bread.

V. ADVERBS OF INTERROGATION

I. In general, an interrogation, in Iloko, is distinguished from a statement merely by the inflection of the voice.

II. Besides several adverbs of interrogation which have been studied under the Number, the following are the most used interrogatives introducing a sentence in Iloko.

1. *Kaanó ti* (ordinary form) and *iti aniá ti* (rarely used), "when?" Examples:

kaanó ti isasañgpétna	when did he arrive?
kaanó ti yaáymo manén	when will you come again?
kaanó ti panagsardéñgda	when did they stop?
kaanó ti pannañganyo ditóy	when do you eat here?
kaanó ñga aldáw ti panañgyegyo	on what day will you bring it?
iti aniá ñga aldáw ti ipapánna	on what day will he go?

2. *Intonanó ti* (most common form), *intón kaanó ti*, *tonanó ti*, *ton kaanó ti*, *attonanó ti*, *adton kaanó ti* or *attón kannó ti*, *antonanó ti*, *anton kaanó ti*, "when?" (future). Examples:

intonanó ti yaáymo	when will you come?
intonanó ti kayátyo a pannakaarámidná	when do you want it made?

intonanó ti kaaddá ti nákemda	when will they have sense?
intón kaanó ti panañgyégda	when will they bring it?
tonanó ti pannakasápulna	when is it needed?
ton kaanó ti pannagnáda	when will they walk?
attonanó ti konáyo	when do you think?
attón kaanó ti panagkayátda	when will they like it?
antonanó ti panagápit	at what time is the harvest?
antón kaanó ti panagbáyadmo	when will you pay?

NOTE 18. Nowadays these forms are very often superseded by *kaanónto*. Examples:

kaanónto ti panañgiserrékna	when will he bring it in?
kaanónto ti panagódoñgmi	when will we go to town?

3. *Adín* (*o*) *ti, sadín* (*o*) *ti,* "when?" Examples:

sadín ti papanánna	where does he go?
sadíno ti nakabirókam kadakuáda	where did you find them?
adín ti nagtarayán ti áso	where did the dog run?
adíno ti paglutoányo	where do you cook?
sadín ti kayátda a pakaikabílanna	where do they want it located?

4. *Asín* (*o*) *ti, si asíno tí,* "who?" Examples:

asíno ti mayát	who is willing?
asín ti piliém	whom do you choose?
asín ti lakáy ñga immáy idí kalmán	who was the old man who came yesterday?
si asíno ti napán	who went?
si asínoak tapnó dayáwendak	who am I that you should honor me?

5. *Anía tí* (ordinary form) *aná ti,* "what?" Examples:

aniá ti konám	what do you say?
aniá ti kayátmo	what do you want?
aniá ti pagságadko	with what can I sweep it?
aniá ti ginátañgda	what did they buy?
aniá ti ilábasyo	with what do you pass?

6. *Anía ti gapóna, ápay* (ordinary forms), *apay-ápay* (mostly used in literature), *apayá* (rarely used), "why?" Examples:

anía ti gapóna ñga immáyka	why did you come?
aniát gapóna a madída	why do they refuse?
aniát gapóna ñga awán ti mayát	why is nobody willing?
aniá ti gapóna a nabarték manén	why is he drunk again?
aniát gapóna a bimmassít ti árak	why did the wine diminish?
ápay a suká ti inkábilyo	why did you put vinegar?

ápay a didakami kitkitáen	why don't you look at us?
ápay ñga áso ti ginátañgda	why did they buy dogs?
ápay ñga awán ti sumangpét	why does nobody arrive?
ápay a siká ti baonénda	why do they send you?
apayápay mapánkayo	why do you go?
apayá umáy	why does he come?

7. *Kasanó ti, an-anoén, agan-anó* (past: *nagan-anó*), "how?" Examples:

kasanó ti pannakaarámidna	how was it made?
kasanó ti panagtaráyko no nasakít ti sákak	how can I run if my foot hurts?
kasanó ti panañgbírokko kadakuáda	how can I look for them?
an-anoén a bayádan ti útañg no awán ti pirák	how can one pay one's debts if there is no money?
an-anoék daytá	how can I do that; what must I do with that?
agan-anókam a bumaknañg	how can we get rich?
nagan-anóka a rimuár	how did you get out?

8. *Agpaanó* (past: *nagpaanó*), "in what direction?" Examples:

agpaanó daytá lakáy	in what direction does that old man go?
nagpaanókayo idí kalmán	in what direction did you go yesterday?

9. *Tagaanó* (ordinary form), *yanó*, "from where?" Examples:

tagaanó dagidiáy	from where are those ones?
tagaanókayo	from where are you?
yanóka	from where are you?

Note 19. The same question may be asked this way: *Aniá ti ílim?* "what is your town; from where are you?"

III. Most of these interrogatives may be used either as adverbs of interrogation or as conjunctions introducing an incidental clause, in which latter case they are preceded by the simple conjunction *no*. Examples:

ammók pay no kaanó ti yaáyna	I don't know when he came.
ibagám no intonanó ti panañgyegmo ití bagás	tell me when you will bring rice.
dinámagko no sadíno ti napanánna	I asked where he went.
saritáem no adíno ti nañgalaám	tell us where you took it.
saludsúdem no asíno ti mayát	ask who is willing.

ammóda no si asíno ti nagtákaw	they know who stole.
isúrona no aniá ti dálan	he shows them where the road is.
ipalawágna no aniá ti gapóna a madída	he explains why they refuse.
inpadámagna no ápay ñga awán ti immáy	he told me why nobody came.
díkayonto panunóten no kasanó wenno aniá ti saoényonto	take no thought how or what to speak
kitáenyo dagití ubbing no kasanó ti idadakkélda	look at the children how they grow.

NOTE 20. Formerly the adverb *ñga* was generally used to introduce an interrogative sentence, but actually it has become entirely obsolete, and it only exists in the complex adverb *ñgáman*.

IV. *Ñgay, aya* and *ñgamin* are adverbs of interrogation which nearly always follow some other word. *Ñgaman* or *náman*, which is not used very extensively, stands by itself or introduces the sentence.

1. *Ñgay* is a simple interrogative. Examples:

ápay a madíka ñgay	why do you refuse, what is the matter?
ápay ñgay	why, what is the matter?
aniá ti birókem ñgay	what are you looking for?
sadín ti yánmo ñgay idí kalmán	where were you yesterday?
aniá ti kalintegánna ñgay	what right has he?
napanánna ñgay	where did he go?
ni Juán ñgay	and John? (where is he; where is his share?)
ket ti panagádalmo ñgay	and your studies? (when talking to a boy or a girl who wants to marry, for instance)
sa pay awán ñgay	why shouldn't there be any? (answering contradictorily a person who said there wasn't any)

NOTE 21. The form *ay* for *ñgay* has become antiquated.

2. *Ayá* and *ñgamin* are interrogatives implying an additional notion of wonder. Examples:

napának ayá	did I go? (implying the contrary)
siák ayá ti baonényo	is it I you send? (I thought somebody else)
ínka ayá	do you go? (I thought you wouldn't or not yet)
pudnó komá ayá	it should be true, wouldn't it be nice?
aláem man ayá	all right, take it (why not?)
aniá ketdín ayá	stop it (or: what can be done?)
nalukmég ayá	is he really fat?
ápay sakít ayá ñgamín	why, is it sickness indeed?

siák ayá ñgamin	I? (do you suppose I did it, not at all)
saánda ñgamín a sañgapúlo, dagití nadalusán	were not ten made clean? (and why do I see only one?)
addá ñgamín nagkúrañg kadakayó	were you really in need of something?
bulsékkami met ñgamín	are we blind indeed? (do you consider us as blind?)
mabalínna ñgamín ti agsublí	can he go back? (I think not)
ñgamín komá no addá ások	I wish I had a dog.
mabalínda ñgamin ti aglidáy	can they grieve? (I think not)
dakdakkélda ñgamín ñgem ni áma	why, indeed, they are taller than my father.
ití ñgamin Abra ti paggapoán ti káyo	the timber comes from Abra (who would have thought that?)
namáti ñgamín kenkuána ti maysá kadakuáda	one of them believed in him, isn't it strange?
saán ñgamín a daytáy ti anák ti allawágí	was not that the carpenter's son?
itédmo ñgamín ti kankanén	you are giving sweets (we didn't know that)
kastáy ti nagtutulágantay ñgamín	did we agree to such a course of action? (I thought the contrary)
agpaysó ñgamín	is it true, really?
awán met ñgamín pirák	well, there is no money (we thought there was)
apayá ñgamín a dítay ipatpatég ti kukuatayo	why indeed don't we prize our belongings?

3. *Ñgámán* or *náman* means "why?" and so on. Examples:

náman	what is the matter? why?
ñgáman apó ñga awán ti nákemko tapnó isú ti aramídek	why, Sir, do you think I have no sense that I should do that?
ñgáman itá a di met naipákat itóy dagátayo	why is it now that it was not given to this country of ours?
ñgáman pay ñga ikkánnak ngatá ti pagduaduaák kenkuana	why do you seem to make me doubt him?
ñgáman pay a mariknák daytá	why do I feel that?
ñgámansa no gumátañg dítóy ti págay	what if I buy rice here?

NOTE 22. The interrogative *man*, "why?" which follows the word it modifies, is very little used nowadays, except in the expression *saán man*, "why not?," "certainly," when answering affirmatively a negative question or its equivalent, and in the complex adverb *ñgáman* or *namán*. Examples:

díka man mamáti	why don't you believe?
saánka a napán ayá?—Saán man	didn't you go really?—I went though.
saánkansa a napán?—Saán man	you didn't go I believe?—I went though.

VI. ADVERBS OF QUALITY AND MANNER

I. To indicate continual repetition of an action, the word expressing the action is twice repeated and the abverb *la* from *láeñg* followed by the ligature *a* or *ñga* connects the two. Examples:

sarita la a sarita daytá lakáy	that old man does not stop talking.
saóka la a saó	you are talking all the time.
bumassít la a bumassít ti bagás	the rice becomes less and less.
lumukmég la a lumukmég ti ubíñg	the child grows fatter and fatter.
umadú la ñga umadú ti dódon	the locusts increase in number all the time.
sáñgitda la a sáñgit	they are always weeping.
pumúdawda la a pumúdaw	they become whiter and whiter.
ñgumísit la a ñgumísit ti rúpam	your face becomes blacker every day.
taráy la a taráy	running all the time.
lumálo met a lumálo	it becomes worse and worse.
siák la a siák ti baonényo.	you always send me.

II. The concept of completeness, purity, and so on, is expressed by the following words, which are connected with the word they modify by the ligature *a* or *ñga: Pasig, biig, bin-ig* (preceding) and *pulos* (following or preceding). Examples:

pásig a tuláñg	all bones.
biig ñga allíd	pure wax.
bin-íg a balitók	pure gold.
pulós a sinamáy	all of it sinamay.
awán a pulós	there is nothing at all.

III. 1. "So" is rendered into Iloko by the indefinite adjectives in *kas, kastóy, kastá,* and so on. Examples:

aramídem a kastá	do it so.
kastóy latta	like this all the time.
kasdíáy a natáyag	as tall as that; so tall.
kastáy ñga adú	as much as that; so much.
kasdí a bassít	as little as that; so little.
kastóy a dakkél	as great as this; so great.

2. "Equally" is expressed by *páda* or *agpáda* (past: *nagpáda*) with ligature *a* or *ñga* following. Examples.

ti pádana a natañgsít	his equal in pride.
nagpadpádada a nadagsén	they were equally heavy.
agpadpádada a nalag-án	they are equally light.
dagití pádami a napañgláw	our equals in poverty.

NOTE 23. The latter is an expression the Iloko generally use, instead of saying "the poor" and so on, whenever they refer to a quality which is humiliating to their neighbor. It would be rather bad taste to say that a man is poor, without referring to him as one's equal in poverty, even though one be as rich as Croesus.

dagití pádami a nanenñgnéñg	our equals in stupidity.

IV. Other adverbs of quality and manner are:

1. *Únay*, "very much" (following, no ligature). Examples:

dakkél únay	it is very great.
bassít únay	very little.
kayátko únay	I like it very much.
ipapílitna únay	he insists much.
magná iti nadarás únay	he walks very fast.

NOTE 24. *Bassít* means "a little" and so on. Examples:

dakkél bassít	rather great.
adú bassít	rather much.
nadagsén bassít	rather heavy.
adayó bassít	a little far; rather far.

2. *Amañgán* (ordinary form), *amamañgan, allek* (rarely used), "how great" (preceding). Examples:

amañgán a nagadú ti táo	how many men.
amañgán a nagrikút únay	how very difficult it is.
amañgan a saldítmo ñgatá a buybuyáek	looking at you I think you must be exceedingly well-favored.
amañgán imbág ti balávyo	how good is your house.

3. (*Nañg*) *nañgróna, sañgkañgrona*, "especially." Examples:

daytóy ti nañgróna a dákes	this is especially bad.
nañgróna únay iti bigát	especially in the morning.
isú ti ñañgnangrona a bassít	he is especially small.
sañgkañgrónada a napintás	they excel in beauty.

NOTE 25. This adverb has a form of relative superlative: *kañgronáan*. Examples:

ti kañgronáan a túleñg	the deafest of all.
ti kañgronáanda a dákes	the worst of them all.

4. *Istáy, nagistáy, nagistayán*, "nearly" (preceding, no ligature). Examples:

istáy natnág	he nearly fell down.
nagistáy naitibkúl	he nearly stambled.
nagistáyak natáy	I nearly died.
nagistayán pimmánaw	he was nearly gone.

5. *Ñganñgáni di, ñganñgáni saán, apáman* (ordinary forms), *apagapáman, apaganamá*, "scarcely" and so on. Examples:

ñganñgáni di agúni	it scarcely sounds.
ñganñgáni saán a mañgñgeg	it is scarcely audible.
apáman a nañgtéd	he barely gave.
apáman a nagságadda	they hardly swept it.
apáman addá	there is just a little.
apáman ta mayát	he is but just willing.

6. *No maminsán,* "in a way" and so on (no ligature). Examples:

no maminsán nasayáat	it is good in a way.
no maminsán kayátko	I more or less like it.
napintás no maminsán	it is beautiful in a way.

7. *Sígud,* "originally" and so on ligature *a* or *ñga.* Examples:

sígud a dákes	it is intrinsically bad.
sígud a bulsék	he was born blind.
nabaknáng a sígud	he has always been rich.
sígud ñga awán ti kúkuana	he never had any property.
sígud a nakasúrat	he had always been able to write.

8. *Úray* (*no*) *kasanó, uray* (*no*) *ipapaanó,* "anyhow, anyway" (no ligature). Cfr. VIII. Other Adverbs. I. 3.

9. *Mabayág* (past: *nabayág*), *kalkalá* (*pay*) (ordinary forms), *makamanó, makamanmanó* (rarely used), " a long time" and so on. Cfr. II. Adverbs of Time. III. Note 9. Examples:

mabayág ti panañgpátitda	they ring the bells for a long time.
addá a nabayágen	he is here a long time already.
nabayágak a nañgálan	I took some a long time ago.
kalkalá pay ti isasañgpétko	I arrived a long time ago.
kalkalá pay ket díka pay nalpás	sucn a long time and you have not yet finished it.

10. *Apagbalikás, apagdarikmát apagkanitó, apagkigmát, apagdipás, saán a kakigmátan,* "in a short time" and so on. Examples:

maláto ití apagbalikás	it can be cooked in a very short time (the time of pronouncing a word)
rimmuár ití apagdarikmát	he came out in a moment.
sumañgpétto ití apagkanitó	he will be here in a moment.
nakarubbuát ití apagkigmát	he was ready in the twinkling of an eye.
apagdipás a naibús ti sabá	the bananas were consumed in a very short time.
saán a kakigmátan addán	one moment and here he is already (before the eye twinkles)

11. *Pagamoán,* "at once" and so on (preceding, no ligature). Examples:

pagamoán addá	it appears at once.
pagamoán nagtálawen	he was gone unawares.

12. *Darás* "quickly" and so on (following, no ligature). Examples:

maibús darás	it is used quickly.
agsubli darás	he returns quickly.
umúlogkat darás	go down quickly.
makalípat darás	he forgets easily.
aramídem darás	do it quickly.

13. *Manén*, "again". This adverb either stands by itself or follows immediately some other word. *En* may be separated from *man* and joined to some other word further down in the sentence, and then it follows the rules of the simple adverb *en*. Cfr. II. Adverbs of Time. IV.

II. Adverbs of Time. IV. Examples:

napán manén	he went again.
ápay a nabartékka manén	why are you drunk again?
siká manén	you again?
addá man daytá lakáyen	that old man is there again.
nagsakít man idí kalmánen	he got sick again yesterday.
kasdí man met láengen	just like that again.
napán man nagtákawen	he went again to steal.
addátay man áminen	we are here again all of us.
awán man ti makítamon	don't you see anything again?
nagsubli man kaniákon	he came back again to me.
addá man ití biáñgmin	he is again under our care.

14. *Píli*, with the meaning of "what should not be", is rarely used (preceding, no ligature). Examples:

píli ket dída saplíten ti nasúbeg únay	why don't they rather whip the very disobedient one?
píli natáy ti baknáñg ditóy íli-tayo	the rich man of our town died, why he?
píli nabóoñgda ti kapintásan a burnáy	they must break just the nicest jar.

VII. ADVERBS OF QUANTITY

I. The concept of excess is expressed in Iloko by:

1. The term *napálalo* or *nalabés*. Examples:

napalálo a dakkél	too big.
napalaló a nasadút	too lazy.
dákes a napalálo	too bad.
nabannógka a napalálo	you are too tired.
uminúm ití napalálo	he drinks too much.
mañgánda ití napalpalálo	they eat too much.
nalabés ti ñgínana	it is too expensive.

2. The adverb *únay* following immediately the word it modifies and the conjunction *tápno* introducing an incidental clause. Examples:

naimbág únay a táo tapnó mapanúnotna a balsén	he is too good a man to think about revenge.
ay-ayaténka únay tapnó mabalínka a buybuyáen a di arakúpen	I love you too much to be able to look at you without embracing you.

II. "Only" is expressed in Iloko by:

1. The adverb *láeng*, which always immediately follows some preceding word without connection by ligature. When another word follows, it is often abbreviated into *la*. Examples:

siák láeñg	I only.
úray ti láeng panangságidko	even only my touching him.
isúda láeñg ti pangikkánna	he gives only to them.
daytóy a ragsák sa láeñg maragpát iti kalpasán ti adú a panagleddáañg	this joy will only be obtained after much sorrowing.
táo la ti addá	only men are there.
agbídañg latta	she just wears a tapis and that's all.
sáñgit la ti ammóna	he knows only weeping.

NOTE 26. This adverb is extensively used in Iloko. We have seen some instances before and we shall see more of them in due time. Sometimes the change it effects in the meaning of the sentence is very slight and often practically nil; therefore we shall give some examples of its use here. Examples:

siák láeñgen	let me do it.
awán la ti umáy	nobody has come yet.
matúrogka láeñg	go on sleeping.
úrayka láeñg	it depends on you.
napúdot pay láeñg	it is still warm.
makítam la no addá idiáy	you will see it if he is there (that it is worse than what you thought).
di pay la pimmánaw iti baláyna	he has not left his house yet.
konák lan nalaklakáda	I thought though that they were cheaper.
díak la idá napagraém	I was wholly unable to have them respect him.
masápulmi la únay	we need it very badly.
ínka láeñg	all right, you can go.
addá pay láeñg	he is still here; there is still some left.
awán pay láeñg	he is not here yet.
adú pay láeñg	there is still much left.

2. The reduplication of the initial, open syllable of the stem with the next consonant, if there is any, of the personal pronouns

of the first series, of the complete forms of the demonstratives, of some numbers (cardinal numbers, distributives, and so on), of the prefix *saŋ̃ga* and so on. Examples:

sísiak	I only.
dakdakamí	we only.
daydaytóy	only this one.
dagdagitóy	only these ones.
up-uppát	four only.
walwaló	only eight.
is-isú	he is alone.
sagsaglilimáda	they have only five each.
sagsagsasaŋ̃gapúlo	only ten each.
saŋ̃gsaŋ̃gaburnáy	only one jarful.
dúdua láeŋ̃g a dálan	only two roads.
banbannógda ti mamagbagá	it is useless for them to give advice. (literally: only their labor in giving advice.)

NOTE 27. The forms *datdaytóy, datdaytá,* and so on, instead of *daydaytóy, daydaytá,* and so on, sometimes occur.

3. The reduplication of the first or of the second part of the complex prefix of the multiplicatives; in the latter case *mami* and *mamin* become *maminpi* and *maminpin* respectively. Examples:

namnaminsán	only once.
namnaminpúlo	only ten times.
maminpinsán	only once.
maminpitló	only three times.
maminpinsiám	only nine times.

NOTE. 28. *Maminpisán* may also mean "completely". Example:

parútekto a maminpinsán	I shall grub it up completely.

III. "A little" is rendered into Iloko by:

1. The term *bassít* following the word immediately without any ligature. Examples:

naturéd bassít	he is rather bold.
addá bassít	there are just a few.
maŋ̃gán bassít	he eats a little.
yadayóna bassít ití dagá	he puts it a little distance from the earth.

2. The term *addá* or *awán* followed by the principal word in which the initial, open syllable is reduplicated together with the next consonant if there is any. Examples:

addá tultúleŋ̃gna	he is a little deaf.
awán ti taktakrótda	they are not timid at all.

addá pañgpañgkísmo	you have a cast in the eye.
addá samsam-ítna	it has a tinge of sweetness.

NOTE 29. The prefix *kanika* adds the meaning of "less than" to a number. Cfr. The Number, I. Cardinal Numbers. IV. Note 1.[87] Example:

kanikapát	less than four.

IV. The multiplicatives and the distributives, which were studied under the numbers, are connected with the word they modify:

1. By the ligature *a* or *ñga*, when they precede;
2. By the article in the oblique, when they follow. Examples:

naminduá a napán	he went twice.
maminpátkami a mañgán	we eat four times.
namitlóda a nagayáb	they called three times.
naminwalóda ñga agtaráy	they run eight times.
saggaysáda ñga agsublí	they come back one by one.
sagpapátda a napán	they went four by four.
nagtaráyak ití naminsán	I ran once.
gumátañgkaminto ití mamitló	we shall buy three times.
nagikkísda ití naminduá	they shouted twice.
agulbódda ití maminríbu	they lie a thousand times.
nagsáñgit ití kapamitlóna	he wept for the third time.
nañgálada ití sagduduá	they took each two.

1. Adverbs implying affirmation, confirmation, and so on: Examples:

1. *Wen*, "yes" (used by itself).
2. *Pay*, "yet, also" and so on (following, no ligature). Examples:

adú pay	there is much left.
addá pay	there is some more left.
agsaó pay láeñg	he still talks.
ni pay Ána	Ann also.
naúyoñg pay	he is also severe.
dakkél pay	it is also big.
bumúlodak pay	I want to borrow more.
ikkánnak pay	give me some more.
bagás pay	rice also.
siák pay	I also.
diak pay nañgán	I didn't eat yet.
saán pay a napán	he did not go yet.
awán pay	he is not here yet.
di pay dimtéñg	he didn't arrive yet.
mañgánka pay sáka mapán	eat first and then go.
di pay nasayáat	is that not good? it is really good.

[87] Anthropos 28 (1933) 711–712.

nakigtótak pay	I was startled (*pay* corroborates the statement).
aramídekto pay no ammók a dákes	would I do it if I knew it were bad?

3. *Agpapán pay, úray,* "even, whatever" and so on (preceding, no ligature). Cfr. Conjunction "Although".[38] Examples:

agpapán pay sañgalubóñgan	even the whole world.
díak kiníta agpapán pay ti rúpa ni amám	I did not see even your father's face.
úray isú napán met	even he, he went also.
úray áso awán	there is nothing, not even a dog.
úray siák	I also.
awán natáy ñga úray maysá	nobody died, not even one.
úray no kaanó ti konám	whenever you say so.
nasayáat úray kaanó	it is always good.
umáykayo úray no anó	come any time.
úray dagitá ásoda met	even those dogs of them, they also.
úray anó díak kayát	I don't like it at all.
úray no sadín ti yánda mabiró-kanminto	wherever they are we shall find them.
addá ití úray sadíno a yan ti lúboñg	it is all over the world.
úray no si asíno	whosoever.
ayatén ti úray si asíno a maka-kíta	whoever sees it loves it.
úray si asíno ti addá ayabám	call whomsoever is there.
úray no aniá ti konána	whatever he says.
úray aniát kíta a tagiláko	any kind of merchandise.
úray aniá a sakít ñga addá ken-kuána	whatever is his ailment.
madíak úray no kasanó	I won't anyhow.
úray ipapaanó ti umiggém	howsoever we can take hold of it.
úray kasanó ti panañgay-áyona kaniák	howsoever he coaxes me.

4. *Ñgarud:* confirmatory (ordinarily following, no ligature). Examples:

ínka ñgarúd	go now (your reasons convinced me; do as you told me).
mapának ñgarúden	I am going now (as I told you; as you told me).
inbagák ñgarúden	I said it (why do you say I did not; why didn't you believe me; I told you so, as it had to be so).
ti ñgarúd kinonána kastóy	now, what he said was like this.

[38] Unpublished.

siák ñgarúden ket addá pay saóyo	it is I, and still you have something to say.
umáy ñgarúd	he is here now (stop your mouth); of course he comes.
aniá ñgarúd ti kayátyo	what do you want (why don't you speak?)
awán ñgarúd	of course he is not there; he is not there indeed.
siká ñgarúden	now you (I can't; you do it as you pretend that you can).
ni Juán ñgarúd ti ayabám	then call John (if you cannot find another one).
uminanáka ñgarúd	take a rest now (as you are tired).
puórak ñgarúd daytá káyo	if so I shall burn that wood.
saányo ñgarúd a kayát	why, you don't like it (why do you object to my taking it?)
ápay ñgarúd a makítam	why, do you see it? (you said you were blind).
intó ñgarúd no umáy matarimáanto ámin	consequently, when he comes, everything will be settled.
ti ñgarúd lakáy ti nañgarámid	of course the old man made it; it was the old man who made it (nobody else).
aniá ñgarúd ti addánto no bigát	then what will happen tomorrow?
ámin ñgarúd a dimñgég nasdáawda	whosoever heard it was astonished (it couldn't be otherwise).
wen ñgarúd	all right (stop asking me for it); yes, isn't it strange?

5. *Ñgad:* abbreviation of the preceding, mostly used in literature (following), no ligature. Examples:

ta nadalús ñgad ámin	because everything was clean of course.
aniá ñgad ti gapóna	then why?
díka ñgad tuláden	thus, don't imitate him.
ti ñgad agturáy ti rebbéñgtay ñga annugóten	thus, we have to obey rulers (no others).

6. *Píman:* confirmatory, ordinarily implying commiseration (ordinarily following, no ligature). Examples:

ta awán pínam ti nakapanúnot	as there was nobody who thought (it's too bad).
anáknaka píman ti okóm ket isút gapóna a kastá ti arámidmo	because you are the son of the judge, is that a reason to behave as you do?
ta babbái ket píman dagití ubbíñg	as the poor children were girls (what could they do?)
ta isú píman awán pay inararámidna	because he hadn't done anything yet, poor man.

maduaduá píman no addá ken panagtagtagainép	he is really in doubt if he is dreaming or not (the news is so very bad).
píman ni María	poor Mary.
kásnak la anák píman	she treated me as a son, poor girl.
dína kayát ti mañgpabaín píman	he doesn't want to make her feel ashamed.
mabaín mettén píman a mañgúlit	he is ashamed now to repeat it, poor boy.
ti anákna a siísem, píman siísem ta dína pay la ammó ti napasámak ti amána	his son who was smiling, smiling indeed, as he did not yet know what happened to his father.

7. *Da:* confirmatory (no ligature). Examples:

da ikkánnak da	now, give me some, quick.
ínnak da	I go now.
da man dínak kikién	leave me, don't tickle me.

8. *A:* confirmatory (at the end of a sentence). Examples:

ínkayo a	go now (why do you wait, I don't keep you back).
mañgtédka a	give me some now, won't you?
isú a	that is he of course; all right then, if you say so.
awán a	there isn't any of course.
madí a	of course he won't.
makaammóka a	that is your business of course.
addá a	he is there of course.
kastán a	so long.
wen a	yes, of course.
adú a	there is much of course.
birókem a	well, look for it.
isúda ti pagdamágam a	ask them (why do you bother me?)
no mapánda ámin úray siák mapánakto met a	if they all go, I also shall go, shouldn't I?

II. Adverbs implying opposition:

1. *Ket, ketdí,* "rather" and so on (following, no ligature). Examples:

addá ket	there is some (why do you say there isn't any?)
sabáli ket ti malagípko	now I am remembering something else.
isú, saán ket a sabáli	he it is and not somebody else.
awán pay met ket ti nasasaóna	he had not said anything yet though.
kas ket bassít ti patégna	as if it were of little value.
ñgem kinonána ket kenkuána	but he said to him though.

a kas ket sakitén ti nákemda	they seem to be sorry about it though.
ñgem kanénda ket ti tinápay	but they eat the bread though.
inarámidda ket kenkuána dágup ti kinayátda	but they treated him howsoever they liked.
naálana a di ket naslép	he took it without getting wet at all.
dína ket maibbatán	he doesn't let it go though.
awán ket a pulós ti linabásanna	he didn't skip anything at all though.
awán ket kenkuána ti úray aniá a dákes	there isn't anything bad in him though.
awán ketdí	there isn't any (why do you deceive me; why don't you believe me).
siká ketdí	you better do it.
nagdaksangásatak ketdín	what bad luck is mine (complaining).
konám ketdí apó, makítam la no addá idiáy	that is what you think, sir, but if he is there, you'll see.
wen ketdí ñgem nañgínansa	all right, but isn't it expensive?
dída la ketdí mabaín	why, they should be ashamed.
wen ketdí no mayát ti bakétko	all right, if my wife agrees.
isúnsa ketdí daytóy ti birbirókem	isn't this what you are looking for?
addánsa ketdí nañgyég kenkuána ití pirák	hasn't somebody given him money?
kayátyonsa met ketdí ti agbalín a pañgoló	don't you act as if you wanted to become chiefs?

NOTE 30. *Get* has become antiquated.

2. *Met, met láeñg, met la* "also, though" (following, no ligature). Examples:

addá met ni kabsátko	my brother is here also (he might not have been, but he is).
awán met	but he is not there (didn't you say he was?)
addá met	he is there though.
madí met	he refuses though.
dagúsenna mettén	now he does it at once.
dí únay adayó met	it is not very far though.
siák met	I also (don't leave me out).
dagití áso pay met	also the dogs (don't exclude them).
awán met ñgamín pirák	well, there is no money (we thought there was).
ni met Luis	Lewis also.
bulsékkami met ñgamín	we are blind indeed (do you think so?)
ti asáwak auán pay met	my wife isn't here yet (I thought she was).

simmañgpét mettén	he has arrived already (don't think he hasn't).
asidég met	it isn't so far.
siká pay met	why, you also?
awán pay met ti mayát	nobody is willing yet (although you said otherwise; although the salary is very high).
awán met la ti mayát	nobody is willing though.
awán met láeñg	he isn't there though.
addá met láeñg	he is here though.
madí met láeñg	he refuses though.
inagawáanna met la ñga inliwliwag darás	he did his best though to get rid of it (sorrow, and so on) quick.
kas met la idí	just as formerly.
daydí met láeñg ti yánna	he is in that same place.
isú met láeñg	it is the same.
daytá met láeñg	that same thing.
ti pugót isú met la ti táo	what we call *pugot* (black one) is just a man.
idí met la kanitó nakakítada	they were able to see on that exact moment.

NOTE 31. "Self," as applied to persons, may be expressed either by the adverb *met laeñg* or by the term *bagí* or *bagí met láeñg*. Examples:

ti bagína komá ti panunótenna	he should think of himself.
pinatáyna ti bagína met láeñg	he committed suicide.
ayaténtayo ti bagítayo met láeñg	let us love ourselves.
siák met láeñg	I myself.
ni áma met láeñg	my father himself.
ni met la Ána ti napán	Ann herself went.
isúda met la ti agbúsor	they themselves are enemies.

III. Adverbs implying doubt:

1. *Ñgatá*, "perhaps" (following, no ligature). Examples:

addá ñgatá ni apó lakáy	is the old gentleman there perchance?
awán ñgatá	maybe he is not there.
siká ñgatá ti nañgála	did you take it perchance?
umáyakto ñgátá	perhaps I'll come.
nayad-addána ñgatá ti nañgán	maybe he only came to eat.
siák la ñgatán ken siká ti addán a sipupúot	maybe you and I were the only ones who noticed it at the time.
agan-anóak ñgatá no sumañgpét ditóy	what can I possibly do if he arrives here?
no kastá komá amañgán ñgatá, ti taknéñg dagiti agturáy	if it were so how virtuous the rulers would be.
amañgán a gagétmo ñgatá ti paliíwek	isn't the diligence I notice in you very great?

idiáy baláy ñgatá ti yánna	maybe he is in the house.
nalukmég ñgatá la únay itán	maybe he is very fat by this time.
ammó ñgatá ti kabsátko	maybe my brother knows.

2. *Sa,* "probably" (always joined to a preceding word; the ligature *n* connects the two if the preceding word ends a vowel). Examples:

addánsa apó	I think he is there, sir.
addánsa pay annákda	haven't they also children?
awánsa	I don't think there is any.
kayátnansa ti sumrék	he probably wants to enter.
wénsa	I think so.
nínsa Pédro (ni Pedrónsa)	Peter probably.
isúnsa ti nagtákaw kadagití bábuymi	I think that is the one who stole our pigs.
uppátsa ti nabáti	I think there are four left.
matúrogdansa	they are asleep probably.

3. *Nalábit,* "probably" (preceding, ligature *a* or *ñga*). Examples:

nalábit a simmañgpéten	he probably arrived already.
nalábit ñga awán	it is profable that there isn't any.
nalábit a kastá	that is very likely.
nalábit ñga ayaténnaka	he probably loves you.
nalábit ñga addá pirákman	you very likely have money now.
nalábit a dué páloda mettén	in all probability they must be twenty by this time.

4. *Agarúp,* "seemingly" (preceding, no ligature). Examples:

agarúp mayát	he seems to be willing.
agarúp madí	he seems to be unwilling
agarúp napigsá	he seems to be strong.
agarúp naimbág	he seems to be good.
agarúp masakít	she seems to be ill.

5. *Komá:* used for the conditional, the subjunctive and the optative (following, no ligature). Cfr. The Verb, Moods and Tenses. V, VI and VII. [39]

6. *Mán, kadí, kad:* entreating (ordenarily following, no ligature). Examples:

siká man	you now (inviting).
mañgtédka man	please, give me some.
siák man	let me do it.
umáyka man	come here, please.
napúdot man	isn't it hot?

[39] Philip. Jour. Sci. 75 (1941) 200–202.

kas man la díka makagun-ód ití kayátmo	you seem not to obtain what you want.
pagarupémsa man a diák mabalin ti agdáwat	do you think perhaps I can't ask for things?
kasdí man met láeñg ti inarámidna	he behaved in exactly the same way.
díkansa man marikná	you don't seem to feel it.
dákes man ti partáañgna	he probably foresees bad news.
man met láeñg	wait a moment (I'll get you).
mañgálaka man ití danúm	please, get water.
kitáem kad a siayát toy ílimi	please, look with favor upon our town.
diká kad láeñg mapán	don't you go? (you certainly should)
kaasiánnak kadí	please, have mercy on me.
tuloñganyo kadí	you should help him.
pakawanem kadí	please, forgive it.
ipaáymo kadí a kalak-ámanmi	please, allow us to partake of them.
idawátannakam kad ití amám	please, ask your father for us.
ínnak kad indeñgán	let me go and pay attention to it.
úray kadí ket ti biág ababá únay	never mind, life is very short.
di kadí manmanó ti táo a makapanúnot	isn't it a shame how few people have sense?
di kad met la siká ti pañgikumiták	isn't it you to whom I entrust it?
aniá kad daytóy a maipaáy ití adú a táo	what is this for a great number of people?
aniá kad ti konák idí	what did I tell you some time ago?
dakámto kad ket ñga addaán makán	how could we have food? (richer people haven't).
námakto kad a liwliwáda	great will be their consolation.
índakto kad pay patién	will they believe me? (I doubt it).
madaydáyaw kadí ti amám	your father should be honored.
saán kadí apó	no, sir, please.
umikkátka kadí	go away, please.
aniánto kad ketdí kenkán a bassít ti pammátina	what is the matter with you having so little faith.

Note 32. *Man* is extensively used in Iloko and is very often placed between two parts of a complex conjunction, instead of following the said conjunction at it stands. Cfr. The Conjunction, passim.[40]

IV. Adverbs implying wonder:

1. *Gáyam* (following, no ligature). Examples:

ni áma gáyam	it's my father (I didn't expect him).
kastáka gáyam	that is the kind of man you are (I shouldn't have thought it).

[40] Unpublished.

addá ayá gáyam	is there any, really?
simmañgpét gáyam ti anákmo	your son came home (I didn't know that).
isú gáyam	it's he (I thought it was somebody else).
awán gáyam	there isn't any (I thought there was).
ni gáyam Ána ditóy	well, this is Ann (isn't it strange?)
addáka gáyam ditóy	you are here now (I didn't know that).

2. *Giém* (following, no ligature; often pronounced diem).

awán pay giém	there isn't any yet (I thought the contrary).
duá pay ti ginátañgko giém	I bought two (and still you don't mind).
awán met giém ti aramídek	I don't do anything to you (why are you angry?)
konána idí gímoñg apó giém	he said it in the assembly, sir (yes, really).
isú ti saóna giém	that is what he said.
adú giém ti kúkuana ket di pay mañgtéd	he has so much and nevertheless he does not give.
saán met giém	no, not at all.
ti komá árak giém apó	better the wine, sir (we prefer the wine).
maysá pay ti gatáñgek komá giém	I should like to buy one more.
sagwawaló komá giém	it should be eight each.
ínnak komá kumíta giém no addáda	well, let me go and see if they are there.
no addá met kúkuak giém	well, I also have some (and still you leave me out).
suktám man ití naiñgiñgpís giém	change it, please, into a thinner one.

V. Adverbs implying resignation:

1. *Aniá ñgay, aniá pay, aniá ñgarúd,* "what can be done? Examples:

aniá ñgay no nákem ti naganák	what can be done if it is the will of the parents.
aniá pay no sígud a dákes	what can be done, he has always been bad.
aniá kad pay no napañgláw met datáo	what can be done, really, as one is poor.
aniá ñgarúd awán met sabáli a pamuspúsan	what can be done, there is no other remedy.

2. *An-anoen* (*kadi*), "what can be done?" Examples:

an-anoén no awán met ti pirák	what can be done if there is no money.
an-anoén kadí no isú ti konána	what can be done if that is what he says.

CHAPTER II: THE PREPOSITION

I. Most prepositions are rendered into Iloko by adverbial expressions followed by the genitive, and by articles or pronouns in the oblique. Examples:

ití teñgñgá ti rabií	at midnight.
ití ñgálay ti dálan	halfway.
ití sakláñg ti okóm	before the judge.
ití sírok ti káyo	under the tree.
ití rabáw ti alsóñg	on the mortar.
ití unég ti burnáy	in the jar.
ití áway ti íli	outside the town.
ití ruár ti baláy	outside the house.
ití teñgñgá ti dálan	in the middle of the road.
ití ígid ti karayán	along the river.
ití báñgir ti karayán	at the other side of the river.
ití dáya ti adígi	east of the post.
ití nagbaetán ti baláy ken ti agámañg	between the house and the granary.
ití bátug dagití bakét	on a line with the old women.
ití ñgáto ti agdán	above the stairs.
ití babá ti túrod	beneath the hill; at the foot of the hill.
ití likudán ti táo	behind the man.
ití masañgoánan ti lakáy	in front of the old man.
ipakánmo ití áso	feed it to the dog.
ikábilmo ití ólona	put it on his head.
iserrékmo ití abút	put it in the hole.
ilákom kadagití balásañg	sell it to the girls.
gatañgem ken Ána	buy it from Ann.
ibagám ken amám	tell it to your father.
itédmo kenkuána	give it to him.
yégmo kaniák	bring it to me.
aláem kadakamí	take it from us.
ikkaték itóy ubíñg	I take it away from this child.
ibítinmo itá káyo	hang it on that tree.

II. 1. "From", indicating the place, is expressed by:

a. *Aggapó* (past: *naggapó*), literally: it comes from; followed either by the oblique or by a preposition or an adverb of place. Examples:

aggapó idiáy Bontók	from Bontoc.
aggapó sadí láñgit	from heaven.
naggapó ditóy	from here.

naggapó idiáy	from there.
aggapó ken áma	from my father.
naggapó iti atép	from the roof.
aggapó itá baláy	from that house.
naggapó itáy lakáy	from that old man.

b. The prefixes *i* or *taga* joined to the name of the place. Cfr. The Adjective. II. Special Forms. 5.[41] Examples:

tagasolsóna	he is from Solsona.
ibintár	he is from Bintar.

2. "From", indicating the place or the time, is expressed by:

a. *Mañgrugí* (past: *nañgrugí*) literally: it begins at; followed either by the oblique or by a conjunction, a preposition or an adverb. Examples:

mañgrugí ken Ána	from Ann.
mañgrugí itóy káyo	from this tree.
mañgrugí idiáy karayán	from the river.
mañgrugí idiáy	from there.
mañgrugí iti bigát	from morning.
mañgrugí idí kalmán	since yesterday.
mañgrugí no rabií	from this evening.
mañgrugí itá	from now.

b. *Manípud* (past: *nanípud*), literally: it begins at; *sípud*, literally: beginning. Both are either followed or not by the same terms as the preceding. Examples:

manípud iti karayán	from the river.
manípud kadagiti il-íli	from the towns.
manípud ken António	from Anthony.
nanípud idiáy balámi	from our house.
manípud ditá	from there.
manípud Lawág	from Lawag.
sípud ditóy	from here.
sípud ken Juána	from Joan.
manípud iti parbañgon	from early in the morning.
manípud no bigát	from tomorrow.
nanípud itáy bigát	since this morning.
manípud itá	from now on.
nanípud kinaubíñgna	since his babyhood.
manípud siám ti biláñgen	from the ninth of this month.
sípud idí napán a tawén	since last year.
sípud no bigát	from tomorrow.
sípud itá	from now.
sípud kinaubíñgna	since his babyhood.

[41] Anthropos 26 (1931) 483–484.

III. "To" or "till", indicating the place or the time, are expressed by:

1. *Agpapán,* from the prefix *agpa* indicating direction and the stem *pan,* "going." Examples:

agpapán ità	until now.
agpapán malém	until afternoon.
agpapán bigát	till morning.

2. *Agtuñgpal* or *manuñgpal,* literally: it finishes at: followed either by the oblique or by a conjunction, a preposition or an adverb. Examples:

agtuñgpál ken Ána	to Ann.
agtuñgpál ditóy	to here.
manuñgpál idiáy baláyyo	to your house.
manuñgpál no agsápa	till early tomorrow morning.

3. *Iñggá,* literally: end. *Iñgganá,* literally: its end, *agiñgá,* literally: it ends; *agiñgána* (the same as *agiñggá* with an incorrect addition of the pronoun *na*). These prepositions are followed or not by the same terms as the preceding. Examples:

iñggá ità	till now.
iñggát malém	till afternoon.
iñggána iti agdán	to the ladder.
iñggána ditóy	to here.
iñggánat iti iñggána	eternally (literally: till its end).
iñggána ken patáy	till death.
iggánat iti tuñgpál ti lúboñg	until the end of the world.
iñggána iti maikapitó	to the seventh.
iñggánat no bigát	until tomorrow.
iñggána ità	till now.
iñggánat tuñgpál biágko	till the end of my life.
agiñggá ken Juán	to John.
agiñggá iti maikatló a búlan	till the third month.
agiñggát masañgoánan	till later; until the future.
agiñggánat ità	till now.

IV. 1. "With" is ordinarily included in the prefixes *maki, tagi* and *ka,* in the combination *ka . . . an,* and in the prefix *i* combined with the prefixes *sañga* or *sañgka.* Cfr. The substantive, III. Formation of Substantives. III. 4; and The Verb, The Adjectival Prefix *maki;* The Adjectival Prefix *ag.* b. III B. 1; The Substantival Prefix *i.* b. II. Note 6. B. and so on.[42]

[42] Anthropos **26** (1931) 472–473; Philip. Jour. Sci. **69** (1939) 231, 235–237; **71** (1940) 20.

2. Sometimes "with" is expressed by the preposition *agráman,* followed or not by the oblique, or by the preposition *patí,* followed by the nominative. Examples:

agráman kadagití kakabsátna	with his brothers.
agráman kadagití adálanna	with his disciples.
agráman kaniák	with me.
agráman baláy	and also the house.
agráman annákna	with his children.
agráman ámin	with all.
dagití gayyémko patí ni Ána	my friends and also Ann.
inálana ti baláy patí dagití alikámenna	he took the house and also its furniture.
ti pirákmi patí ti pagan-anáymi	our money and also our clothes.

V. "Toward" is included in the prefixes *agpa* and *ipa.* Cfr. The Verb, The Substantival Prefix *ipa;* Verbs Implying Order or Permission. II A. 1.[43]

VI. Other prepositions are:

1. *Idiáy,* "at, in, to, into" and so on (in general). Examples:

addá idiáy Lawág	he is at Lawag.
addá idiáy baláy	he is in the house.
simmañgpét idiáy pagdigúsan	he arrived at the bathing place.
mapán idiáy babá	he goes to the lowlands.
simrék idiáy agámañg	he entered the granary.
agyán idiáy tálon	it stays in the rice fields.
immúli idiáy atépna	he climbed on its roof.

2. *Sadí* "in, to," and so on (exclusively with geopraphical names and terms). Examples:

adú ti magátañg sadí Maníla	much can be bought in Manila.
agnaéd sadí Bulakán	he dwells in Bulacan.
nagádal sadí Amérika	he studied in America.
ínka sadí abagátan	go south.
napán sadí amiánan	he went north.
immúli sadí láñgit	he ascended to heaven.

NOTE 33. Sometimes the name of the place follows another word immediately without any preposition or article. Examples:

mapán Maníla	he goes to Manila.
napán láñgit	he went to heaven.

3. *Babaen,* "through," and so on, followed by the genitive. Examples:

babaén ti palúbos dagití agturáy	with permission of the authorities.
babaén ti panañgibábaetna	through his mediation.
babaén ti pannakaibelléñg ti dárana	through the shedding of his blood.
babaén ti panagsublída	through their coming back.

[43] Philip. Jour. Sci. 71 (1940) 20–22, 26–27.

4. *Malaksíd,* "except," followed by the oblique. Examples:

malaksíd iti púsayo	except your cat.
malaksíd ken gayyémko	except my friend.
malaksíd kadagití áso	except the dogs.
malaksíd kadakayó	except you.

NOTE 34. Other prepositions, which at the same time may be used as conjunctions, will be studied under the Conjunction.

ASPLENIACEÆ AND BLECHNACEÆ OF NEW GUINEA *

By Edwin Bingham Copeland
Of the University of California

SIX PLATES

ASPLENIACEÆ

Genus ASPLENIUM Linnaeus

Brause, Engler's Jahrb. **56** (1920) 144–152, nearly three decades ago, listed 49 species in this genus. Two of these are *Athyrium*. One or two others are probably included because of wrong identification. He overlooked one published species; five have been published in subsequent years; two known elsewhere have been found here; and three are here described as new. The number to be accounted for would seem to be about 56, of which I can distinguish, by comparison or description, about 45. In support of the reductions, except as to my own species, the isotypes available for comparison are mentioned.

Fronds simple and entire.
  Nest-forming, with marginal vein.
    Sori broad, long, approaching margin.
      Base gradually narrowed ..... 2. *A. Phyllitidis*
      Base broad, sessile ..... 3. *A. cymbifolium*
    Sori shorter, narrow, close in full fruit..... 1. *A. Nidus*
  Not nest-forming, veins free.
    Sori paired, facing one another.
      Fronds uniform, oblanceolate ..... 46. *A. schizocarpum*
      Linear-lanceolate; juvenile fronds compound ..... 47. *A. scolopendropsis*
    Sori not paired.
      Frond coriaceous or subcoriaceous.
        Fronds over 25 cm long.
          Apex acute or acuminate.
            Surface squamuliferous ..... 4. *A. vittaeforme*
            Surface naked.
              Costa prominent ..... 5*a*. *A. acrobryum*
              Costa depressed ..... 5. *A. comosum*
          Apex cuspidate ..... 6. *A. Werneri*
        Frond under 25 cm long
          Rigidly coriaceous ..... 7. *A. durum*
          Subcoriaceous ..... 4*a*. *A. morobense*

* Report on the Third Archbold Expedition, etc.

Frond herbaceous.
Rhizome slender, green ..... 8. *A. papuanum*
Rhizome stouter, brown ..... 9. *A. amboinense*
Fronds pinnate to bipinnatifid.
Small ferns with axes dark and polished.
Pinnae rounded at apex.
Fronds under 1 cm wide ..... 10. *A. Trichomanes*
Fronds broader ..... 11. *A. normale*
Pinnae more or less acute.
Apex of pinnae nearly equal-sided ..... 12. *A. unilaterale*
Lower side of pinnae almost wanting ..... 12*a*. *A. filipes*
Mostly larger, axes not dark and polished.
Lamina herbaceous, green.
Pinnae large, not very oblique
Rachis not winged ..... 13. *A. subemarginatum*
Rachis winged upward ..... 13*a*. *A. Regis*
Lower or all pinnae conspicuously oblique.
Proliferous by slender rhizomes ..... 14. *A. bipinnatifidum*
Not proliferous by rhizomes.
Pinnae under 5 cm long.
Lower pinnae distant, reduced ..... 15. *A. monotis*
Frond truncate at base.
Pinnae merely toothed ..... 16. *A. tenerum*
Pinnae pinnatifid ..... 16*a*. *A. decorum*
Pinnae longer.
Surface naked ..... 17. *A. remotum*
Surface squamulose ..... 18. *A. persicifolium*
Lamina more firm, usually brownish.
Fronds up to about 5 cm wide.
Larger pinnae incised.
Fronds up to 2.5 cm wide ..... 19. *A. gracile Fée*
Fronds about 5 cm wide ..... 20. *A. planicaule*
Pinnae not lobed.
Frond compact ..... 21. *A. pellucidum*
Frond long and lax ..... 22. *A. keysserianum*
Well developed fronds larger.
Rachis proliferous ..... 23. *A. cromwellianum*
Not proliferous.
Pinnae excised on lower side.
Rachis more or less scaly ..... 24. *A. acutiusculum*
Rachis glabrescent ..... 25. *A. falcatum*
Base incompletely excised.
Pinnae distinctly stalked ..... 26. *A. macrophyllum*
Pinnae almost sessile ..... 27. *A. Sancti-Christofori*
Fronds bipinnate or more compound.
Sori dorsal (not marginal).
Segments linear-cuneiform, 1 mm wide ..... 28. *A. insititium*
Segments distinctly wider.
Rachis bulbiferous.
Pinnules toothed ..... 31. *A. hapalophyllum*

Larger pinnules subpinnate ..... 29. *A. Foersteri*
Tripinnate ..... 30. *A. paedigens*
Not proliferous.
Indusia with parallel sides.
Pinnules not deeply cut.
Fronds clustered, thin ..... 40. *A. kelelense*
Fronds remote, firm ..... 35. *A. setisectum*
Pinnules incised or pinnate.
Segments cuneate, 2–3 mm wide.
Rhizome scandent..... 36. *A. Brassii*
Rhizome short.
Rachis fibrillose ..... 32. *A. lanceolatum*
Rachis glabrescent.
Frond lax ..... 33. *A. laxifolium*
Frond compact ..... 34. *A. tafanum*
Segments broad.
Fronds firm to coriaceous.
Pinnules rounded ..... 37. *A. cuneatum*
Pinnules subacute ..... 37*a*. *A. affine*
Fronds thin.
Bright-green ..... 38. *A. laserpitiifolium*
Black-green ..... 39. *A. Shawii*
Indusia boat-shaped, ends acute ..... 40. *A. nutans*
Sori elongate, straight, free side marginal.
Frond pinnate or subbipinnate, small..... 41. *A. subpinnatifidum*
Fronds decompound, large ..... 42. *A. scandens*
Sori short, marginal to apical (Loxoscaphe).
Fronds up to 10 cm long ..... 43. *A. Bakeri*
Fronds much larger.
Fertile segments mostly entire ..... 44. *A. novo-guineense*
Fertile segments mostly furcate ..... 45. *A. Schultzei*

1. A. NIDUS L.

A. Nidus L., Sp. Plant. (1753) 1079.

Brass 8966, 11320, 12903, 12951, alt. 20–2,200 m; *Carr 12040; King 425.*

Old-World Tropics.

Questionably distinct from *A. Nidus* is *A. ellipticum* (Feé) Copel., Elmer's Leaflets 3 (1910) 819. Referable to it are *Brass 11373, 12385, 13742, 13863, 12903; King 424;* and *Clemens s. n. Brass 8974* is intermediate between these and what I suppose to be typical *A. Nidus. Brass 13742* seems to be exactly *A. nidiforme* v.A.v.R.; and *Carr 11898* is like it.

Philippine; Borneo; Java.

2. A. PHYLLITIDIS Don

A. Phyllitidis Don, Prod. H. Nepab (1825) 7.

Brass 14047, 13800, Idenburg River, alt. 50 m; *King 422, 423, 286.*

These are unlike typical *A. Phyllitidis* of India in having a veinlet which runs under the free edge of the indusium, and, as the latter curls back after maturity, gives superficially the same appearance as *A. scolopendrioides* J. Sm., in the case of which this appearance is not due to a vein. There is no such vein in typical (?) *A. Phyllitidis,* and only a suggestion of it in *A. simonsianum.* I suppose that all reports of *A. Phyllitidis* in New Guinea are based on this atypical form. The same peculiar vein is found in many collections from the central and southern Philippines, including *Cuming 319*, from Samar.

3. A. CYMBIFOLIUM Christ.

A. cymbifolium Christ, Bull. Boiss. II **6** (1906) 999.

Brass 12076.

Philippines.

The preceding three species represent Presl's section *Thamnopteris.* Because all have been construed as forms of *A. Nidus,* and even mixed in collection, their distribution and synonymy are uncertain.

4. A. VITTAEFORME Cav.

A. vittaeforme Cav., Descr. (1802) 255.

Brass 11500, Bele River, alt. 2,200 m.

Both *A. vittaeforme* and *A. squamulatum* Blume have been reported from New Guinea. As to their probable identity, see Christensen, Dansk Bot. Arkiv **9** (1937) 18. To his observations, it may be added that I have complete specimens from the type region, identified as *A. squamulatum,* which are certainly Cavanilles' species. All Philippine "A. squamulatum" is this species, which is also in Borneo and Sumatra. My Java specimens so named are distinct, but I suspect wrong identification.

4a. ASPLENIUM MOROBENSE Copel., sp. nov. **Plate 1.**

Micropodium, rhizomate adscendente, 5 mm crasso, paleis ovatis acuminatis brunneis usque ad 6 mm longis vestito; stipitibus confertis, 10–23 cm longis, gracilibus, paleis parvis dense, sed sursum decidue, vestitis; lamina simplice, 15–25 cm longa, 3.5–4.5 cm lata, acuminata, haud prolifera, basi cuneata vix decurrente, integra, subcoriacea, costa paleis paucis minutis deciduis praedita, alibi glabra, inferne pallida; venis liberis, late patentibus; soris ca ¾ marginem versus elongatis, indusiis 0.8 mm latis, sporangiis longissime pedicellatis, annulo 20–cellulare, sporis oblongo-reniformibus, episporio hyalino, haud spinosis.

New Guinea: Morobe, Boana, alt. 800–1,300 m. *Mary Strong Clemens No. 41541.*

In the same group and from the same region is *A. Werneri* Ros., which I have not seen. It is described as larger throughout, which might well not be a real difference. But it is said to be abruptly acuminate, and rounded at the base, while the eight fronds of *A. morobense* in hand are all gradually narrowed to both ends. The lamina of *A. Werneri* is described as scaly; the immature frond of *A. morobense* bears sparse, minute, amorphous, ferruginous squamulae on the upper surface, and is promptly glabrescent. The nether surface, even as the frond grows, is practically glabrous.

5. **A. COMOSUM** Christ.

A. comosum Christ, in Schum. & Lauterb., Fl. dent. Südsee (1901) 127.

I do not know the type. *Schlechter 16609* might be authentic, but its costa is prominent, even carinate on some fronds.

Endemic.

5a. **A. ACROBRYUM** Christ.

A. acrobryum Christ, Nova Guinea 8 (1909) 150.

Brass 12198, with long, winged stipe; *13711*, with long (10 cm) terete stipe; *13813*, attenuate downward and subsessile; *King 120 A, 393* and *s. n.*

There was considerable confusion in the numbering of King's specimens, and, understanding that I had a complete set of his later collections (some earlier ones went to Bailey only), I suppose that one of these just cited is the plant sent to Buitenzorg and reported as *No. 320*, the type of *A. paucidens* v.A.v.R. This is a very variable plant, but I believe that all specimens cited above are one species. *Brass 13183* is identical with *Schlechter 16609;* if that specimen is correctly named, all are *A. comosum.* It is noted that Christ closed his comment on *A. acrobryum* with "Conf. *Asplenium comosum* Christ de la Nouvelle Guinée orientale."

6. **A. WERNERI** Ros.

A. Werneri Ros., Fedde's Repert. 5 (1908) 39.

Not seen. The type is *Werner No. 3*, from Mt. Gelu. Reported also as *Ledermann 12516*. Reported as with rhizome 5 cm. thick, short-creeping and then suberect; frond long-stipitate, subrounded at base, obtuse and abruptly acuminate. Probably near *A. vittaeforme.*

7. A. DURUM Copel. Plate 2.

A. durum Copel., Univ. Calif. Publ. Bot. **18** (1942) 222.

Rhizomate breve, valido, paleis ovatis acutis brunneis circa 3 mm longis vestito; foliis confertissimis, sessilibus, integris, lineari-oblanceolatis, usque ad 23 cm longis et 17 mm latis, acutis, deorsum longe attenuatis, prope basin inferne parce paleatis aliter nudis, rigide coriaceis, costa applanata, venis immersis furcatis in marginem cartilagineum plus minus deflexum terminantibus; soris ad costam et marginem fere attingentibus, angulo 45° seriatis, indusio lato brunneo crasso.

Dutch New Guinea: Balim River, alt. 1,600 m, *Brass 11639;* "occasional on bare limestone on deforested slopes; leaves fleshy." The description is of the larger of the two individuals. The larger fronds of the smaller one are 7.5 by 1 cm, but fruiting freely.

Distinguished from *A. apoense* and *A. ensiforme* by sessile fronds; from *A. simplicifrons* by the position of the sori; more rigid and naked than any of these. Such plants as this must be supposed to be reduced relatives or forms of species of normal size for the group, the reduced stature and the texture being functions of exposure. Some features of resemblance to another local species suggest *A. cymbifolium,* which in full development has fronds a meter by 20 cm; but the paleae are different.

8. A. PAPUANUM Copel.

A. papuanum Copel., Philip. Jour. Sci. **6** (1911) 79.

Known only by the type, *King 287.* Possibly a juvenile *A. amboinense,* but not to be reduced on the evidence in hand.

9. A. AMBOINENSE Willd.

A. amboinense Willd., Sp. Plant. **5** (1910) 303.

Brass 11258, 12436, 12897, 13623, 13657, 13858, 13663, alt. 700 to 1,100 m. *No. 13657* is aberrant, with subsessile fronds, minutely but rather freely squamulose surfaces, and remote marginal teeth.

Malaya.

10. A. TRICHOMANES L.

A. Trichomanes L., Sp. Plant. (1753) 1080.

A specimen collected by Mrs. Clemens is this species, broadly construed.

Cosmopolitan New to New Guinea.

11. A. NORMALE Don

A. normale Don, Prod. Fl. Nepal. (1825) 7.

Brass 12212, 12437, alt. 1,750 m. For first New Guinea report, see Christensen, Brittonia 2 (1937) 290, *Brass 5451* and *5549.*

Asia, Africa, Malaya; reported from Queensland.

12. A. UNILATERALE Lam.

A. unilaterale Lam., Enc. 2 (1786) 305.

This comprehensive species is reported from New Guinea, but all specimens I have seen are referable to *A. filipes.*

Africa; Asia; Polynesia.

12a. A. FILIPES Copel.

A. filipes Copel., Philip. Jour. Sci. 3 (1908) 34.

Brass 13850, alt. 130 m. Collected also by King and by Mrs. Clemens. A segregate of *A. unilaterale.*

Philippines.

13. A. SUBEMARGINATUM Ros.

A. subemarginatum Ros., Fedde's Repert. 5 (1908) 372.
A. Kingii Copel., Philip. Jour. Sci. Bot. 6 C (1911) 79.
A. pseudovulcanicum v.A.v.R., Nova Guinea 14 (1924) 8.

Brass 13859, 13900, alt. 55 and 120 m; Damun, *Wernes 68.*

13a. A. REGIS Copel., sp. nov. **Plate 3.**

A. rhizomatis apice solummodo viso valido; stipitibus fasciculatis, 15–20 cm longis, brunneis, paleis lineari-lanceolatis 2–4 mm longis, interdum ramis lateralibus ornatis, persistentibus vestitis; lamina 30 cm longa, non prolifera, pinnata foliola apicale pinnis lateralibus simile, rhachi minute et sparse paleata, sursum alata ala 1 mm lata; pinnis utroque latere circa 6, infimis vix diminutis, medialibus 8 cm longis 2 cm latis, acutis, alato-pedicellatis basi suboblique late cuneatis, grosse serratis, herbaceis, viridibus, inferne sparse squamuliferis; venis erecto-patentibus, furcatis; soris linearibus nec costam nec marginem attingentibus. Plantae juvenilis stipitibus 6 cm longis, lamina jam fertile 12–15 cm longa deorsum bipinnata, rhachi ubique alata.

Papua: *King 380.*

Probably related to *A. remotum,* as indicated by the bipinnate fronds of the juvenile plant. I do not feel altogether sure that this is not *A. cesatianum* Baker, known only by Baker's description and by Christensen's reduction to *A. persicifolium,* which this certainly is not. Juvenile plants might have been unknown; but Baker could hardly have overlooked the alate rachis; the pinnae are coarsely serrate, not crenulate; and I find no large paleae at the bases of the stipes.

Isotype in Herb. Univ. Calif.; Lakekamu, *King 357* (type of *A. Kingii*), *300*. The isotype of *A. subs emarginatum* and the Brass specimens are proliferous at the apex; the apex of King's fronds is wanting. The lowest pinnae of *King 357*, but not of *No. 300* nor the Brass specimens, are forked; we have not the base of *Werner 68*. The type of *A. pseudovulcanicum* is *Lam 671*, with *Lam 674* and *742* also cited, from the Mamberamo River, about sea-level. I have not seen them, but the description shows no distinctive feature.

Endemic.

14. A. BIPINNATIFIDUM Baker

A. bipinnatifidum Baker, Synopsis (1867) 221.

Brass 12381, 12889, alt. 1,200 and 1,500 m. Apparently common. The pinnae vary from entire through lobed to subpinnate. For synonymy, see Christensen, Dansk Bot. Arkiv **9** (3) (1937) 47.

To Fiji, and reported in Celebes.

15. A. MONOTIS Christ

A. monotis Christ, in Schum. & Lauterb., Nachtr. (1905) 43.

Known only by the type collection. Described as with small sterile and much larger fertile fronds.

16. A. TENERUM Forster

A. tenerum Forster, Prod. (1786) 80.

Brass 8930, Cyclops mountains; *13757*, *14120*. Common throughout New Guinea.

Asia to Tahiti.

16a. A. DECORUM Kunze

A. decorum Kunze, Bot. Zeit. **6** (1848) 176.
Darea Belangeri Bory, Bél. Voy. Bot. 2 (1833) 51.
Asplenium tenerum var. *Belangeri* of authors.

Reported from New Guinea as var. *acuminata* Ros., on the basis of *Werner 13*, also as *Ledermann 9293*. Pinnae said to be up to 12 cm long. Described from the upper part only of a frond; very likely not this species.

17. A. REMOTUM Moore

A. remotum Moore, Index (1859) 160.
A. ludens Baker, Jour. Linn. Soc. **19** (1882) 294.

Reported from New Guinea are *A. dubium* Brack., and *A. multilineatum* Hooker, respectively *A. remotum* Moore and *A. ludens* Baker, all as var. *dareoides* Ros.

First as to the name: Brackenridge described *A. dubium* and *A. distans,* both applying to the same common Fiji species, both names pre-occupied, *A. dubium* applying to a sterile juvenile form with dissected leaves, the fronds of the adult plant being simply pinnate. Moore substituted *A. remotum* for *A. distans.* Then Hooker substituted *A. multilineatum* because he found Moore's name inappropriate. *A. ludens* was described from the Solomons, supposed to be distinguished by short sori, perhaps really distinguishable by minute squamules instead of narrow paleae of some size on the creeping or eventually scandent rhizome; it, also, has dissected fronds on juvenile plants.

Following the description of *A. multilineatum* var. *dareoides,* Rosenstock, Fedde's Repert. **10** (1912) 327, proceeds: "Das wir es bei ihm mit einer dareoiden Form von *A. multilineatum* Hk. zu tun haben, ergibt sich einmal aus dem charakteristischen braunen, kletternden Rhizom mit seinen kleinen, braunen Schüppchen, das bei beiden genau übereinstimmt, sowie zweifellos aus einem in meinem Herbar befindlíchen Wedel des *A. multilineatum* (1. Bamler, Neu-Guinea), der neben den typischen ungeteilten Fiedern andere von der Form der var. *dareoides* trägt." We have such a specimen from Rosenstock, 1. Werner, bearing three fertile, strictly pinnate fronds, and a number of manifestly juvenile dissected fronds. From Alston, we have *Carr 11677,* wholly sterile, but with both dissected and simply pinnate fronds, the latter clearly representing a transition from juvenile to adult. I have also *King 496,* 1. Rev. P. C. Shaw from mountains behind Taupotu, to which I gave but did not publish a new name, distinguishing it from *A. remotum* by the minutely squamulose rhizome, and from *A. ludens* by sori extending to the margin. The latter distinction will probably not hold, and the former deserves more observation. These three specimens represent one species, almost certainly *A. ludens,* probably also *A. remotum.* Its dissected fronds are juvenile; adult plants bear pinnate fertile fronds. As to the variety *dareoides,* see also No. 42, *A. scandens.*

Solomon Islands; Fiji.

18 A. PERSICIFOLIUM J. Smith

A. persicifolium J. Smith: Mett., Asplenium (1859) 97.

A. cesatianum Baker. Cf. Christensen, Dansk Bot. Arkiv **9** No. 3 (1937) 46.

Collected by Beccari, *teste* Christensen.

Philippines; Celebes.

19. A. CLEMENSIAE Copel., sp. nov. **Plate 2**

A. rhizomate breve, paleis fuscis nigrescentibus lanceolatis attenuatis vix 1 mm longis vestito; stipitibus approximatis, 2–3.5 cm longis, brunneis decidue paleolatis; lamina 10–15 cm longa, 2–2.5 cm lata, acuminata, basi aut truncata aut paulo angustata, subbipinnata, papyracea, brunnescente, glabra, rhachi in parte superiore prolem gerente; pinnis brevi-pedicellatis, valde obliquis, majoribus cum pinnula una acroscopica late cuneata sessile, parte apicale pinnulae aut incisa aut tantum dentata dentibus paucis; soris secus venas fere omnes elongatis, indusio integro persistente.

New Guinea: Morobe, Boana, alt. 1,000 m. *Mary Strong Clemens No. 41740.*

This is a reduced member of the group of *A. insititium* Brack.

A series of one collection, *Copeland 1886,* from Mt. Data, Luzon, the smallest individual of which matches Fée's description and figure perfectly, enables me to identify *A. gracile* Fée as *A. planicaule* Wall. *non* Lowe. Similar in appearance as are the reduced Luzon and New Guinea specimens, they are not immediately related.

Similar to this, but not identical, is *Brass 641,*—see Journal Arnold Arboretum **10** (1929) 178. It is more and more finely dissected, with less salient venation, about the same size, lamina 12 by 2.5 cm, and with tiny buds on some rachises. So far as the resemblance is due to reduction, it does not prove nor even indicate affinity.

20. A. PLANICAULE Wall.

A. planicaule Wall., List. (1828) n. 189 *nomen*: Mett., asplenium (1859) n. 158 *non* Lowe.

Reported from New Guinea, but I have no specimen.

India to Japan and Luzon.

21. A. PELLUCIDUM Lam.

A. pellucidum Lam., Enc. 2 (1786) 305.

Probably common at moderate altitudes.

African Islands to Polynesia.

22. A. KEYSSERIANUM Ros.

A. Keysserianum Ros., Fedde's Report. **10** (1912) 328.

Known only by the type collection, *Keysser 26,* from Sattelberg; isotype in Herb. Univ. Calif.

23. A. CROMWELLIANUM Ros.

A. cromwellianum Ros. Feddie's Report **10** (1912) 327.
A. Ledermanni Hieron, Engler's Jahrb. **56** (1920) 150.

Brass 11243, 11244, 11598, 12220, 12865, 13383, alt. 850 to 2,200 m. variable; pinnae obscurely or sharply toothed, or with a basal lobe, but none of this collection is as incised throughout as is one frond of *Keysser 19,* the type collection. I have not seen *A. Ledermanni,* but its description does not show that it is without the range of these specimens. Moreover, if these were Philippine specimens, they would be *A. Steerei* Harr.; and I mistrust identity with *A. lobulatum Mett.* These belong to a natural group, within which distinction of species is difficult or impossible.

24. A. ACUTIUSCULUM Blume

A. acutiusculum Blume, Enum. (1828) 178.

Not seen from New Guinea.
Malaya; Philippines; reported from Samoa.

25. A. FALCATUM Lam.

A. falcatum Lam., Enc. **2** (1786) 306.

Common.
Old-World tropics and subtropics.

26. A. MACROPHYLLUM Swartz

A. macrophyllum Swartz, Schroder's Journal "1800" (1801) 52.

While distinct enough in typical forms, both this and *A. falcatum* are very variable in New Guinea and Malaya, and the assignment of intermediate forms to one or the other is uncertain. Bakker and Posthumus, Varenflora voor Java 139, treat them as one species, and I am now so doing in the Philippines. *Brass 11638,* a dwarf growing on bare limestone, alt. 1,600 m. may represent *A. macrophyllum.* And I would give this name to *Hollrung 789,* distinguished by Hieronymus as *A. toyayanum* Wall.

African islands to Polynesia.

27. A. SANCTI-CHRISTOFORI Christ

A. Sancti-Christofori Christ, in Schum. & Lauterb., Fl. dent. Südsee (1901) 128.
A. Goadyi Copel. & Shaw, Philip. Journ. Sci. **26** (1926) 330.

Brass 13956, 14125, alt. 50 m. Apparently common.

Endemic in New Guinea and neighboring islands. *Goadby 1,* the type of *A. Goadbyi,* is from New Britain.

A. Gjellerupii v.A.v.R., Bull. Jardin Bot. Buit. II No. 7 (1912) 7, was maintained by its author, Malayan Ferns Suppl. I 293, as being *A. Sancti-Christofori* Ros. *non* Christ; but I find nothing in the more complete description given there by which to distinguish it from the real *A. Sancti-Christofori.*

28. A. INSITICUM Brack.

A. insiticum Barck; U. S. Expl. XVI (1854) 161, *pl. 22, f. 2*

Brass 12054, alt, 1,800 m; *12037* (?). *Carr 11989* is received as *A. spathulinum* J. Smith, and may be correctly named; but I cannot distinguish it from *A. insiticium.* The two were included in the first description of *A. spathulinum* by Hooker, Sp. Fil. III (1860) 170.

New Caledonia; Fiji; Hawaii; and if *A. spathulinum* be included, the Philippines.

29. A. FOERSTERI Ros.

A. Foersteri Ros., Fedde's Repert. 12 (1913) 168.

Brass 10285, 10543, 10629, 10286, 11242, 11407, alt. 2,300 to 2,800 m. The type is *Keysesr B 51,* isotype in Herb. Univ. Calif. Of Brass' collections, the first three are even more slender than the type, the lamina up to 50 by 5 cm. The last three are much more ample, up to 90 by 27 cm. The first three have more promptly glabrous axes; and are without buds on the rachises of the pinnae, as is also our isotype.

Endemic.

A. cromwellianum, A. insiticium and *A. Foersteri* are closely related species, a group characterized by somewhat fleshy texture and the production of gemmae, at least at some of the upper axils of the rachis. If *A. cromwellianum* is *A. lobulatum* and *A. insiticium* includes *A. spathulinum,* both species range from New Guinea to Luzon (and probably Formosa) and to Hawaii. Whether they are one or two species, or a group of related species, can only be decided with more ample collections than have ever been made.

30. A. PAEDIGENS Copel. **Plate 4.**

A. paedigens Copel., Univ. Calif. Publ. Bot. 18 (1942) 222.

Euasplenium, rhizomate breve, valido, paleis castaneis aciculari-lanceolatis integris rigidis circa 3 mm longis vestito; stipite 25 cm alto 2 mm crasso, griseo-fusco, rhachique sparse fibrillosis

mox denudatis; lamina usque ad 60 cm longa et 25 cm lata, ovata, tri-quadri-pinnata, tenuiter papyracea, glabra, apice flagelliforme cum pinnis remotis vix 2 mm longis linearibus rhachi gemmifera; pinnis fere sessilibus, apice frondis simile sed brevius protractis, infimis paulo brevioribus, inframedialibus usque ad 17 cm longis et 6 cm latis; pinnulis usque ad 4 cm latis, basi oblique truncatis 14 mm latis, apice protractis; pinnulisii maximis 8 mm longis 4 mm latis, ad costam anguste alatam sectis, segmentis 1–3 cuneiformibus 1 mm latis subacutis vel apice fissis; venulis plerumque 2, soris 1 vel 2, linearibus, indusiis laete castaneis integris.

Dutch New Guinea: *Brass 12896,* type, 6 kilometers southwest of Bernhard Camp, Idenburg River, alt. 1,100 m. "Low epiphyte in a rain-forest gulley;" also, *Nos. 12817, 13330, 13752,* alt. 850 to 1,200 m.

Because of its fine dissection, this has the aspect of a *Loxoscaphe* or *Darea,* but the sori are attached on the side nearest the margin. In spite of the gemmate rachis, this is not very close to *A. Foersteri,* being different in texture as well as in dissection. It is not in the group of *A. lanceolatum* (*A. furcatum, A. praemorsum*), in spite of some similarity in dissection.

31. A. HAPALOPHYLLUM Ros.

A. hapalophyllum Ros., Fedde's Repert. **12** (1913) 167.

Brass 9220, 9295 Lake Habbema, alt. 3,225 m; *Brass & Myer-Dress, 10029,* Mt. Wilhelmina, alt. 3,560 m; Morobe, alt. 8,000–9,000 feet, *Clemens s.n. 12384 bis* and the type is *Keysser II 38,* and our specimen is marked "unicum." Brass' specimens are larger, with a few more residual paleae on the fronds, but I am confident of the specific identity. *No. 9296,* the largest, has stipes 20–25 cm long, lamina up to 36 cm long and 15 cm wide, tripinnate in the lower part, pinnules with few (2–4) secondary pinnules, the lowest sometimes forked. Note on the *Clemens s.n.* specimen reads "pendulous, 4–5 feet."

Endemic.

32. A. LANCEOLATUM Forsk.

A. lanceolatum Forsk.: C. Chr., Suppl. III (1934) 36.
A. praemorsum Swartz, Prod. (1788) 130.

Bamler 29 (1913), from Rook Island, received as "Aspl. furcati Thbg. var. an sp. n.", is approximately this "species."

Cosmopolitan.

33. A. LAXIFOLIUM v.A.v.R.

A. laxifolium v.A.v.R., Nova Guinea **14** (1924) 8.

Dutch New Guinea: Doorman-top, alt. 2,500 m, *Lam 1976.* Not seen or not recognized.

Endemic.

34. A. TAFANUM C. Chr.

A. tafanum C. Chr., Brittonia **2** (1937) 291.

Mt. Tafa, alt. 2,400 m, *Brass 4839, 4840.* Not seen.

Endemic.

This and *A. laxifolium* as described are unlike *A. paedigens* in having stalked pinnae.

35. A. SETISECTUM Blume

A. setisectum Blume, Enum. (1828) 187.

A. inciso-dentatum Ros., Fedde's Repert. **12** (1913) 167.

Brass 9297, Lake Habbema, alt. 3,225 m; *Clemens 10154,* Mt. Sarawaket, alt. 11,000 feet; *Keysser B 12,* Bolan mountains, alt. 3,400–3,800 m, isotype of *A. inciso-dentatum* in Herb. Univ. Calif. The reduction of *A. inciso-dentatum* is by Backer and Posthumus, Varenflora voor Java 339; and the fact is not overlooked that Christensen, Brittonia **2** (1937) 290, 291, has listed them as distinct.

Malaya; Luzon.

36. A. BRASSII C. Chr.

A. Brassii C. Chr., Brittonia **2** (1937) 291.

Brass 9854, Wilhelmina-top, alt. 3,560 m, epiphytic in large masses in subalpine forest. The rhizome, like that of *A. setisectum,* is wide-creeping, with remote fronds.

Endemic.

37. A. CUNEATUM Lam.

A. cuneatum Lam., Enc. **2** (1786) 309.

A. affine Swartz, Schroder's Journal "1800" (1801) 56.

37a. A. AFFINE Swartz

These names have been applied rather indiscriminately to specimens from Malaya, New Guinea and Polynesia. The original distinction between *A. cuneatum,* from Jamaica, and *A. affine,* from Mauritius, is that the former has rounded, the latter, subacute pinnules.

Brass 13797, 13957, alt. 50 m. Ample, with board, rounded pinnules, *A. cuneatum* by definition. *King 239, 365,* smaller fronds of the same species. *Werner 69, Rosenstock Fil. Novog.*

Exsicc. n. 1 is smaller and more harsh,—*A. cuneatum* var. *oceanicum* Kuhn. *King 365* and *Bamler, Rosenstock Fil. Novog. Exsicc. 157* can be *A. affine* by definition; both rounded and subacute pinnules are on both. I am of course not proposing the reduction of *A. affine.*

Pantropic, as a group.

38. A. LASERPITIIFOLIUM Lam.

A. laserpitiifolium Lam., Enc. **2** (1786) 310.

Brass 13969, 14046, alt. 50 m. Common near sea-level. Malaya; Polynesia.

39. A. SHAWII Copel.

A. Shawii Copel., Philip. Jour. Sci. **30** (1926) 330.

Known only by the original collection, *1 Shaw, King 494.*

40. A. KELELENSE Brause

A. kelelense Brause, Engler's Jahrb. **49** (1912) 29, *f. 2 A.*

The original collection, *Schlechter 16302,* isotype in Herb. Univ. Calif., is correctly described as having a short, erect rhizome, the fronds fascicled. It looks to me like a juvenile plant, possibly of *A. cuneatum. Rosenstock Fil. Novog. Exsicc. n. 183,* distributed with this name, with a slender, scandent rhizome, is no near relative. Six collections by Ledermann, det. Brause, Engler's Jahrb. **56** (1920) 146, are unknown to me.

Endemic.

41. A. NUTANS Ros.

A. nutans Ros., Fedde's Repert. **12** (1913) 168.

The type collection, *Keysser B 51 A,* Bolan mountain, alt. 2,400–3,000 m, isotype in Herb. Univ. Calif. The indusia look like those of a *Loxoscaphe,* to which it has no other resemblance. *Carr 14072,* Alola, alt. 6,000 feet, is a more ample specimen, with longer and more acute pinnules, more scaly rachis, and longer sori, but probably of the same species.

Endemic.

42. A. SCANDENS J. Smith

A. scandens J. Smith: Mett., Asplenium (1859) 108.
A. multilineatum var. *dareoides* Ros., Fedde's Repert. **10** (1912) 326.
A. remotum var. *dareoides,* Engler's Jahrb. **56** (1920) 146.
A. ludens var. *dareoides* Alston, Jour. Bot. (1939) 289.
A. impressivenium v.A.v.R., Bull. Jardin Bot. Buit. II No. XX (1915) 8.

As to the variety *dareoides*, whatever the specific name, I have already pointed out in discussing *A. remotum*, No. 17 of this enumeration, that the dissected fronds of that species represent juvenile stages and are sterile. The variety *dareoides* is a plant with dissected fertile fronds of mature plants. Its type was collected by Bamler in the Cromwell mountains in 1910. We may not have it, but do have a specimen collected by Bamler in the same place, dated 1912, *Rosenstock Fil. Novog. Exsicc. n. 152*, "Asplenium multilineatum Hk. v. dareoides Ros., n. v." It bears two fronds: one sterile, *A. scandens*, with short, rounded pinnules; the other larger, fertile, with longer subacute pinnules. Similar specimens are *Schlechter 16428*, received as *A. dubium; Lam 1384*, received as *A. scandens*, and *Carr 14790, 15399*, received as *A. ludens* var. *dareoides*.

A. scandens of the southern Philippines,—I have 11 collections from Mindanao and Palawan,—has rather narrow, lanceolate pinnae with short pinnules rounded at the apex. My isotype, *Cuming 297* from Leyte, has longer and more pointed pinnules. In New Guinea, the form with narrow pinnae is apparently common, represented by *Brass 13667, 13846* and *13847*. The variety *dareoides* has distinctly longer, more pointed pinnules. *Brass 12265, 12379* and *12892* are of this form. The extremes look distinct, but the type of the species is intermediate. Juvenile plants, identical from Palawan and New Guinea (*1.* Mrs. Clemens), with fronds down to 5 cm long, are dissected like the adults except as necessarily simplified in mechanical correlation with stature.

Philippines; Solomon Islands.

43. A. BAKERI C. Chr.

Known only by the type collection, from Vanapa Valley, alt. 2,000–4,000 feet.

44. A. NOVO-GUINEENSE Ros.

A. novo-guineense Ros., Fedde's Repert. 5 (1908) 40.

Mt. Gelu, alt. 1,000, *Werner 16* isotype in Herb. Univ. Calif.; Kani mountains, alt. 1,000 m, *Schlechter 17191*.

Endemic.

45. A. SCHULTZEI Brause

A. Schultzei Brause, Engler's Jahrb. 49 (1912) 30.

Brass 12022, 12706, alt. 1,800 and 2,000 m; Sattelberg, alt. 1,500 m, *Keysser 196*. The type, not seen, is *Schultze (33) 77*.

Endemic.

Brause, Engler's Jahrb. **56** (1920) 146, lists *A. achilleifolium* (Lam.) C. Chr. as a New Guinea species. Its presence is improbable.

46. A. SCHIZOCARPUM Copel.

A. schizocarpum Copel., Genera (1947) 165.
Scolopendrium schizocarpum Copel., Philip. Jour. Sci. 1 Suppl. (1906) 152.
Diplora schizocarpa C. Chr., Suppl. III (1934) 78.

Schlechter 10229; Bamler, *Rosenstock Fil. Novoy. Exsicc. n. 96; Keysser 26;* all from Kaiser-Wilhelmsland, alt. 900 to 1,600 m.

Mindanao; very nearly the same form from the Solomon Ids.

47. A. SCOLOPENDROPSIS F. v. M.

Asplenium scolopendropsis F. v. M., Papuan Plants III (1876) 48.
Scolopendrium d'Urvillaei Bory, Dup. Voy. Bot. I (1828) 273.
Diplora d'Urvillaei C. Chr., Suppl. III (1934) 78.
A. Linza Cesati, Rend. Ac. Napoli **16** (1877) 29.
Triphlebia dimorphophylla Baker, Malesia **3** (1886) 42.
Scolopendrium Mambare Bailey, Queensland Agric. Journal (1898) 9.
Phyllitis intermedia v.A.v.R., Bull. Dept. Agric. Ind. Néerl. No. XXI (1908) 6.

It is unnecessary to authenticate this synonymy by citation of the many specimens. I am not now in doubt about *A. scolopendropsis;* but the Solomon Islands plant to which I gave that name, Philip. Jour. Sci. **60** (1936) 114, is nearer to *A. schizocarpum.*

Melanesia; Micronesia; Borneo (?).

BLECHNACEÆ

Genus BLECHNUM Linnaeus

Fronds alike, sori not covering nether surface.
  Margin entire ..... 1. *B. orientale*
  Margin serrate ..... 2. *B. nigropaleaceum*
Fronds dimorphic: Lomaria.
  Fronds pinnatifid or pinnate.
    All sterile pinnae confluent or adnate.
      Dwarfed basal pinnae remote.
        Sterile pinnae over 10 cm long..... 3. *B. saxatile and*
                                            4. *B. Ledermanni*
        Sterile pinnae up to 8 cm long ..... 5. *B. deorso-lobatum*
      Dwarfed basal pinnae contiguous, wide.... 6. *B. Keysseri*
    Only lowest pinnae free, not adnate..... 7. *B. dentatum*
    Most pinnae free.
      Dwarfed basal pinnae present ..... 8. *B. papuanum*
      Dwarfed basal pinnae absent.
        Pinnae subacute to acuminate.

Pinnae entire unless near apex.
Pinnae rounded at base.
Pinnae 12 cm long ..... 9. *B. pendulum*
Pinnae 6 cm long ..... 10. *B. Brassii*
Pinnae cordate.
Apical leaflet like others ..... 11. *B. decorum*
Apical pinnae confluent ..... 12. *B. Archboldii*
Margin not entire.
Pinnae cordate ..... 11. *B. decorum var.*
Pinnae rounded at base.
Costae densely scaly ..... 13. *B. Hieronymi*
Costae sparingly squamulose ..... 14. *B. acutiusculum*
Pinnae obtuse, linear ..... 15. *B. revolutum*
Pinnae rounded, oblong ..... 16. *B. nudius*
Fronds bipinnatifid bipinnate ..... 17. *B. Fraseri*

1. B. ORIENTALE L.

B. orientale L., Sp. Plant. (1753) 1077 (as *B. occidentale*).

Brass 8959, 13485, alt. 850 m. *No. 13486,* with pinna 37 cm long and 2.5 cm wide, might be *B. finlaysonianum* Wall. Common.

To India, and across Polynesia.

2. B. NIGROPALEACEUM Alston

B. nigropaleaceum Alston, Jour. Bot. **78** (1840) 225; Nova Guinea N. S. **4** (1940) 109, *Pl. 4, f. 1.*

Carr 14363, 13336, Boridi, Papua, alt. 5,000 feet; otherwise unknown.

3. B. SAXATILE Brause

B. saxatile Brause, Engler's Jahrb. **56** (1920) 152.

Ledermann 11046, Hunstein Peak, alt. 1,350 m. Not seen.

4. B. LEDERMANNI Brause

B. Ledermanni Brause, Engler's Jahrb. **56** (1920) 153.

Ledermann *11595, 12062,* Schraderberg, alt. 2,070 m; not seen.

The seven species (out of eleven credited by him to New Guinea) described as new by Brause are presumably distinct, and seem to be well described until one undertakes to distinguish them by description.

5. B. DEORSO-LOBATUM Brause

B. deorso-lobatum Brause, Engler's Jahrb. **56** (1920) 154.

Described from *Ledermann 11905, 11932a,* Schraderberg, alt. 2,070 m. To this I refer *Brass 10815,* alt. 2,750 m; and, less confidently, *No. 12353,* alt. 1,700 m. These are one species, but *No. 12353* might be *B. saxatile.*

Endemic.

6. B. KEYSSERI Ros.

B. Keysseri Ros., Fedde's Repert. **12** (1913) 153.

Keysser 220, Sattelberg Hinterland, alt. 1,400–1,500 m; isotype in Herb. Univ. Calif. Well distinguished by the dwarfed basal segments, 2–3 mm long by 10–17 mm wide.

Endemic.

7. B. DENTATUM (Kuhn) Diels

B. dentatum (Kuhn) Diels, in Schum. & Lauterb., Fl. dent. Südsee (1901) 130.

B. bamlerianum Ros., Fedde's Report. **10** (1912) 325.

Bamber L. 39, Logaueng, type of *B. bamlerianum,* not seen. *Bamber, Rosenstock Fil. Novog. Exsicc. n. 115,* Wareo, alt. 600 m; *King 104,* Goodenough Bay, alt. 300–600 m. Related to the Philippine *B. egregium,* intermediate between *Eublechnum* and *Lomaria.*

New Hanover, the type.

8. B. PAPUANUM Brause

B. papuanum Brause, Engler's Jahrb. **56** (1920) 158.

Ledermann 11978, Schraderberg, alt. 2,070 m. Not seen.

9. B. PENDULUM Brause

B. pendulum Brause, Engler's Jahrb. **56** (1920) 157.

Ledermann 11922 Schraderberg, alt. 2,070 m. Not seen.

10. B. BRASSII Copel. **Plate 5.**

B. Brassii Copel., Univ. Calif. Publ. Bot. **18** (1942) 222.

Lomaria, rhizomate scandente, 4 mm crasso, basique stipitis paleis brunneis nonnulis nigrescentibus circa 7 mm longis basi 2 mm latis incurvis acuminatis vestitis; stipitibus remotis (8 cm), primo stramineis, vetustate nigrescentibus, sursum paleis stramineis plus minus deciduis vestitis, frondis sterilis 13 cm, fertilis circa 30 cm altis; lamina circa 30 cm longa, 12 cm lata, basi truncata, foliola apicale maxima usque ad 10 cm longa; frondis sterilis pinnis inferioribus vix reductis, medialibus 6 cm longis 11 mm latis, acutis apice obscure serrulatis, subsessilibus basi rotundatis, coriaceis, costa inferne decidue squamulata excepta glabris; venis gracilibus simplicibus et furcatis obscuris; pinnis fertilibus circa 8 cm longis, 2–3 mm latis, superioribus brevioribus adnatis vix decurrentibus, infimis brevissime pedicellatis.

Dutch New Guinea: Idenburg River, alt., 1,800 m, *Brass 12287.* One plant, climbing on dead trunk, in mossy forest.

Characterized by the long-scandent rhizome and remote fronds, pale-scaly rachis, and complete absence of dwarfed basal pinnae.

11. B. DECORUM Brause

B. decorum Brause, Engler's Jahrb. **56** (1920) 156.

Ledermann 12459a, Sepik region, alt. 1,400–1,500 m; also var. *dilatata*, *Ledermann 11168;* neither seen. To this I refer *Brass 12439*, alt. 1,800 m; roughly, the distal half of each pinna is serrulate.

Endemic.

12. B. ARCHBOLDII C. Chr.

B. Archboldii C. Chr., Brittonia **2** (1937) 288.

Brass 4318, Mt. Albert Edward, alt. 3,680 m, isotype in Herb. N. Y. Bot. Garden; *Brass 4590*, Murray Pass, alt. 2,840 m. Pinnae obtuse to acute; costae clothed beneath with large ovate paleae.

Endemic.

13. B. HIERONYMI Brause

B. Hieronymi Brause, Engler's Jahrb. **56** (1920) 155.

Ledermann 12217b, Schraderberg, alt. 2,000 m. Not seen. *Carr 15132*, smaller than described.

Endemic.

14. B. LATIUSCULUM (v.A.v.R.) C. Chr.

B. latiusculum (v.A.v.R.) C. Chr., Suppl. III (1934) 45.
Lomaria latiuscula v.A.v.R., Nova Guinea **14** (1924) 31.

Lam 1543 Doorman Top, alt. 1,420 m. Not seen.

15. B. REVOLUTUM (v.A.v.R) C. Chr.

B. revolutum (v.A.v.R.) C. Chr., Suppl. III (1934) 46.
Lomaria revoluta v.A.v.R., Nova Guinea **14** (1924) 31.

Lam 1708, Doorman Top, alt. 3,250 m; not seen. *Brass 9442* and *9600*, Lake Habbema, alt. 3,225 m, seem to represent this species.

Endemic.

16. B. NUDIUS Copel. **Plate 6.**

B. nudius Copel., Univ. Calif. Publ. Bot. **18** (1942) 222.

B. fluviatile affine eocumque confusum, rhachi sparsissime paleacea vel nuda et textura firmiore distinguendum.

Dutch New Guinea: 7 kilometers north-east of Wilhelmina-top, alt. 3,560 m, *Brass & Myer-Drees 9966*, type, "Sides of moist sinkholes and chasms in limestone, common;" also, *Brass 9328*,

Lake Habbema, alt. 3,225 m, "Under wet banks of grassland streams; sterile fronds flat-spreading, fertile fronds erect;" *Brass 4733,* Murray Pass, alt. 2,840 m; *Mrs. Clemens s.n.* near and on Mt. Sarawaket, 9,000 to 13,200 feet.

Borneo: Mt. Kinabalu, alt. 11,000 feet, *Clemens 51450.* Other Kinabalu specimens, which I have not, but which are likely to be this species, are *Clemens 27044, 27047 and 38727.* These and *Brass 4733* are determined by Christensen, Gardens' Bull. **7** (1934) 283, and Brittonia **2** (1937) 288 as *B. fluviatile* (R. Br.) Lowe. He states that his Kinabalu specimens (those I do not have) conform with those of New Zealand in scaliness of stipe and rachis. All which I cite from personal observation have the rachis conspicuously more naked or wholly so. The affinity, however, is to *B. fluviatile* rather than to the related New Zealand species, *B. membranaceum* (Col.) Mett., with naked rachis.

The specimens vary greatly in stature, as conditioned by the local environment. The type has stipes 15 cm long, laminae even 30 cm, the fertile and sterile fronds alike nearly erect. *Brass 4733* and Mrs. Clemens' collections from Mt. Sarawaket are rosette-forming dwarfs growing in open grass. *Brass 9328* and *Clemens 51450* are intermediate.

17. B. FRASERI (A. Cunn.) Luerssen

B. Fraseri (A. Cunn.) Luerssen, Flora **59** (1876) 292.

Brass 10814, near Lake Habbema, alt. 2,700 m.

This is var. *novoguineensis* Brause, Engler's Jahrb. **56** (1920) 159, distinguished from the New Guinea species by larger size, leaves narrowed downward, and strongly toothed segments of the sterile pinnae. Only the last feature distinguishes it at all from Christ's var. *philippinensis,* and large specimens of the latter are hardly less coarsely toothed, small specimens having the subentire segments of the New Zealand type.

Genus WOODWARDIA J. E. Smith

W. RADICANS (L.) Smith

W. radicans (L.) Smith, Mém. Ac. Turin **5** (1793) 412.

Brass 11053, Bele River, alt. probably 2,200 m. "Forest undergrowth; common on steep limestone slopes; fronds few, in weak spreading clumps."

The genus seems to be new to New Guinea. The extension of range is significant, because *Woodwardia,* always regarded as a relative of *Blechnum,* is a genus of distinctly northern

distribution, previously known south of the equator in Java only, while its relatives are of evident antarctic origin. The new collection carries the genus back along the track along which the great mass of oriental ferns seems to have immigrated.

As to the specific name, the recent tendency,—see Christensen, Suppl. III 196,—is to distinguish specific segregates long regarded as forms of *W. radicans*, among these, *W. orientalis*, *W. auriculata* and *W. unigemmata*. It is possible to distinguish *W. orientalis* and *W. unigemmata;* but I am not so sure that the latter is not *W. auriculata*, and so prefer for the present to use the most inclusive name. *Woodwardia* is common in the mountains of northern Luzon, and unknown between those mountains and New Guinea. With the material in hand, it is impossible to distinguish the plants of the two regions.

Genus STENOCHLAENA. J. Smith

Fertile pinnae rolled back ..... 1. *S. areolaris*
Fertile pinnae flat.
Fertile pinnae 2–3 mm wide..... 2. *S. palustris*
Fertile pinnae at least 5 mm wide..... 3. *S. juglandifolia*

1. S. AREOLARIS (Harr.) Copel.

S. areolaris (Harr.) Copel., Philip. Jour. Sci. 2 C (1908) 406.

Brass 13417, alt. 850 m, on *Pandanus; Clemens s. n.* Morobe, alt. 1,300 m, on banana and betel. The latter is the first record of the species as growing elsewhere than on *Pandanus*. Other New Guinea records by Holttum are *Versteeg 1102* and *Docters van Leeuwen 9909*.

Luzon.

2. S. PALUSTRIS (Burm.) Bedd.

S. palustris (Burm.) Bedd., Ferns Brit. India Suppl. (1876) 26.

Brass 13938, alt. 50 m; *Brass 936, Carr 11323*, Papua, sea level.

To India and Samoa.

3. S. JUGLANDIFOLIA Presl

S. juglandifolia Presl, Epim. (1849) 164.

Bamber 112p, Sattelberg; *King 167*, Papua; *Bamber R. 1*, from Ins. Rook.

Philippines; Solomon Islands.

As to the distinctness of this species, see Holttum, Gardens' Bull. 9 (1937) 139. Recognized as a species, *S. juglandifolia* is the type-species of the genus.

ILLUSTRATIONS

[All are Photographs of the Types]

PLATE 1. *Asplenium morobense* Copel.
2. *A. durum* Copel.
A. Clemensiae Copel.
3. *A. Regis* Copel.
4. *A. paedigens* Copel.
5. *Blechnum Brassii* Copel.
6. *B. nudius* Copel.

PLATE 1.

PLATE 2.

PLATE 3.

Plants of Netherlands New Guinea TYPE
Herbarium of the Arnold Arboretum,
Harvard University
No. 12992 L. J. Brass Feb. 1939
Low epiphyte in a rain forest valley at 1100 m
6 km. SW of

PLATE 4.

PLATE 5.

PLATE 6.

BOOKS

Books reviewed here have been received by the Philippine Journal of Science from time to time and acknowledged in this section.

REVIEW

Radio Aids to Navigation. By R. A. Smith. Cambridge, At the University Press, New York, The Macmillan Company, 1948. 114 pp. Price, $2.50.

The material for this book was originally prepared as a contribution to the British Ministry of Supply (Air) Scientific War Records, but by permission of that ministry, it was later revised for publication.

This book traces the remarkable development in the application of electronics to navigation during the war and shows how the limitations of prewar radio navigation systems were overcome by the introduction of new techniques particularly by the development of radar. These electronic devices are now widely adapted for air and sea navigation and other works requiring quick and accurate determination of position under any weather condition. Other devices find application in the field of surveying, triangulation and aerial photography.

The book is a good reading matter for the layman interested in the sciences, and to those possessing the basic knowledge of radio this book ushers them into the relatively new field of electronics.—L. G. A.

Analytic Geometry. Revised edition. By Roscoe Woods. New York, The Macmillan Company, 1948. 322 pp. Price, $3.50.

Beginners on analytic geometry will find this book neither too technical nor too elementary because the author introduced each new principle with illustrating examples completely worked out in the text. Of course, there is the usual dose of exercises which are carefully graded at the end of each chapter. All the materials needed in the usual short course in analytic geometry are presented in the first ten chapters; the last five chapters make it fuller and rounder, aside from thoroughly introducing the student to solid geometry and the concepts needed in the study of calculus. The author stepped farther from the usual run of freehand drawings when he

utilized pictures of wire models to represent quadric surfaces in chapter XV. Answers to the odd numbered exercises only are given at the back of the book but the author will furnish upon request an answer-book with answers to even-numbered exercises.—L. G. A.

Strength of Materials. By Joseph Marin. New York, The Macmillan Company, 1948. 464 pp. illus. Price, $4.75.

The designing of structure and machine members is the object of this book. It emphasizes that materials for construction must be simple and cheap yet strong enough to resist the different kinds of stresses be it bending, compression, twist, stretch or shear. It calculates to the minutest detail the kind of stress that is required in the different parts of the structure and machine. The materials that are to compose the structure and machines are to be selected and their strength, calculated in order to enable them to withstand the shock or stresses from within as well as from without.

This book is a good text and reference material. It is highly recommended for engineering students, engineering professors and practicing engineers.—R. R. O.

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